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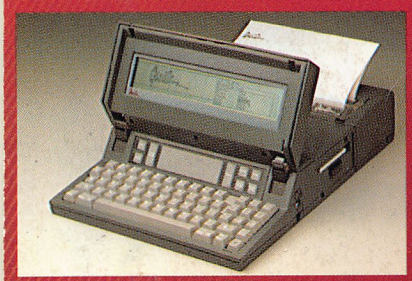

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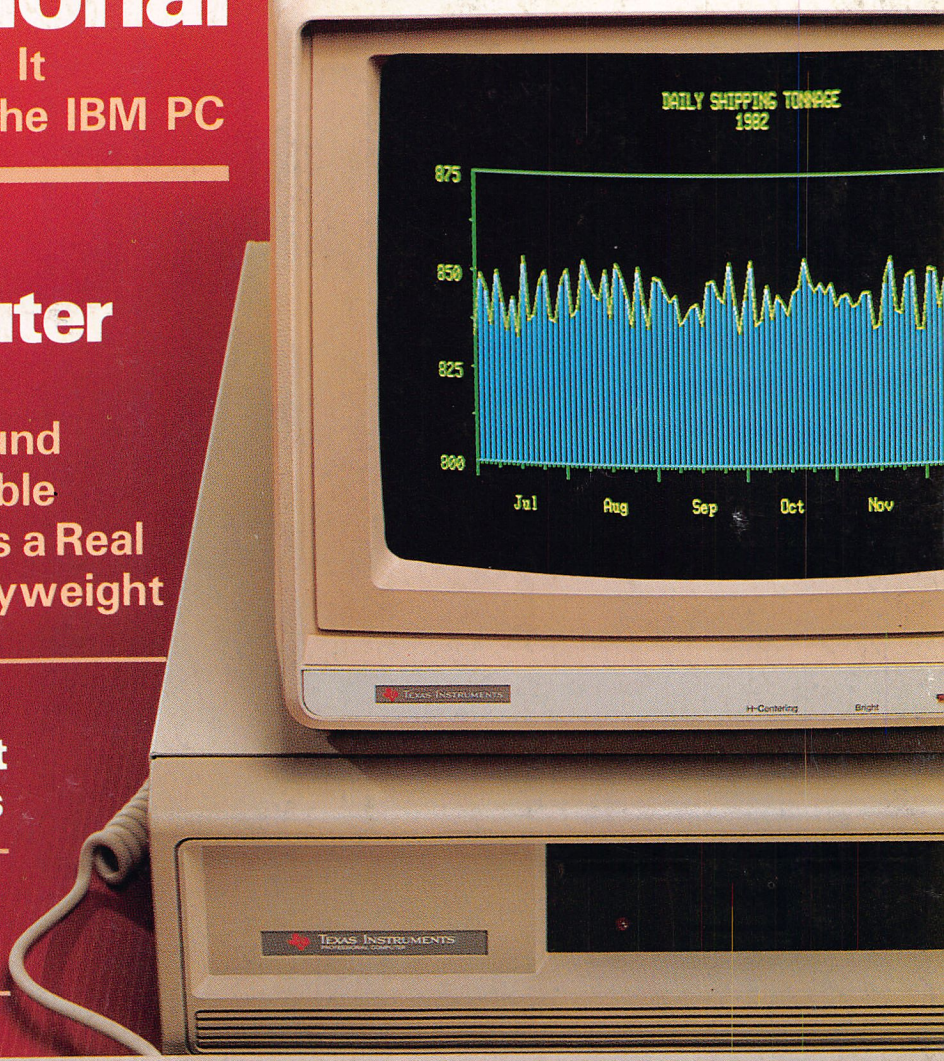

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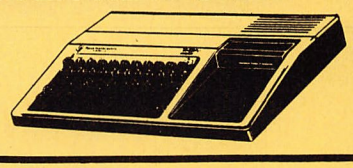

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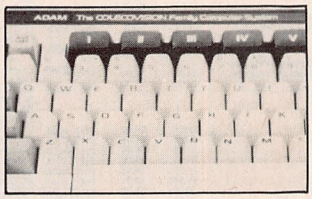

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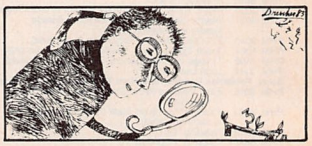

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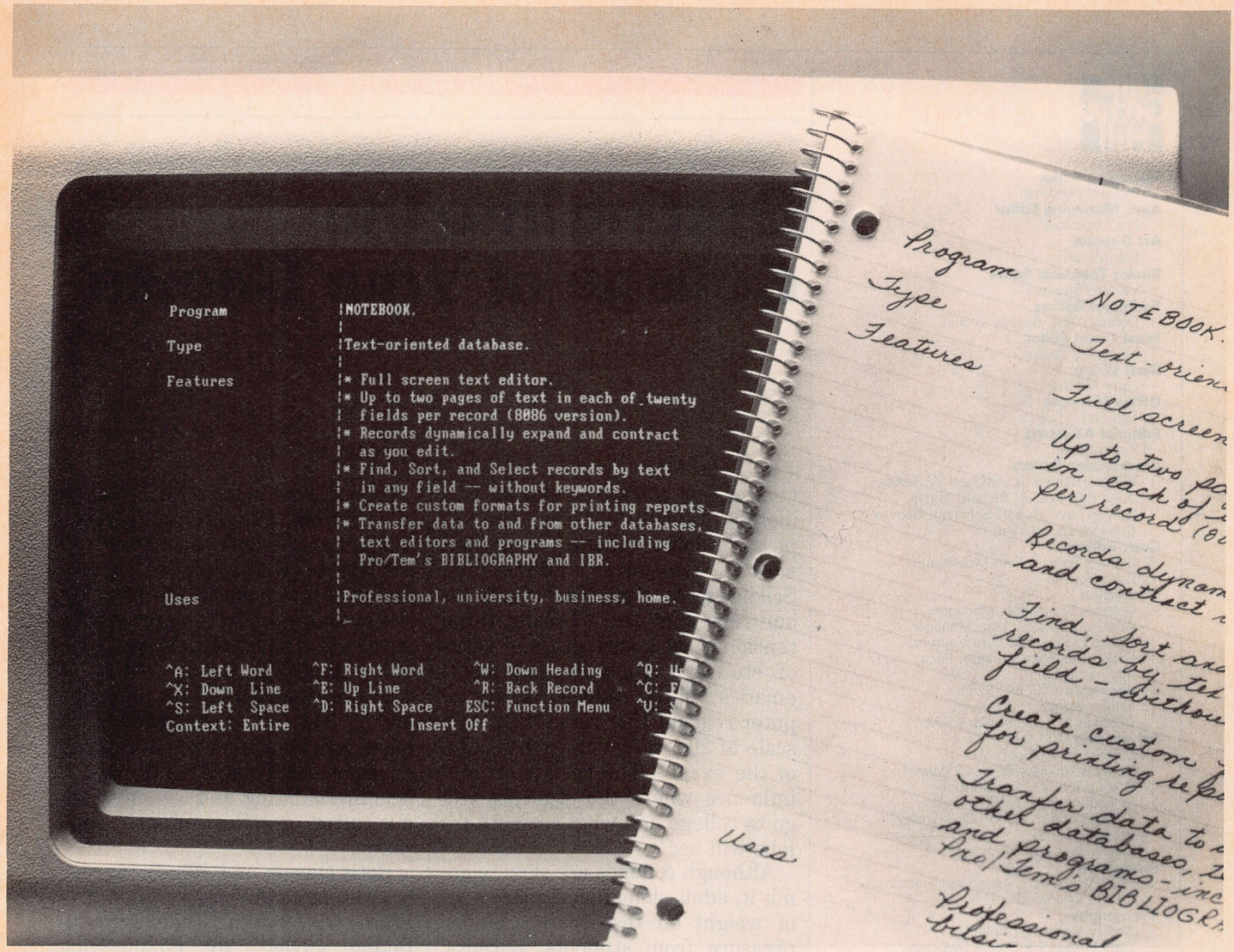

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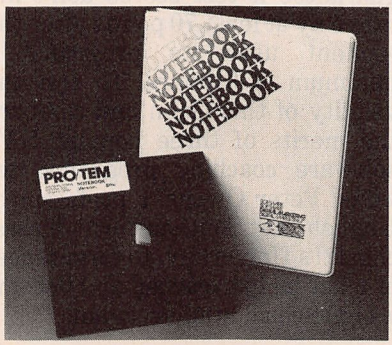

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Getting into the College of Your Choice

One of our software reviews this month focuses on the rite of passage most college-bound high school students endure—the Scholastic Aptitude Test (SAT). As our review states: "During three tension-filled hours all their years of studying language and mathematics will be reduced to a computer readout that rates them on a scale of 200 to 800 on each section of the exam." The results greatly influence where the students will go to college and what their future jobs will be.

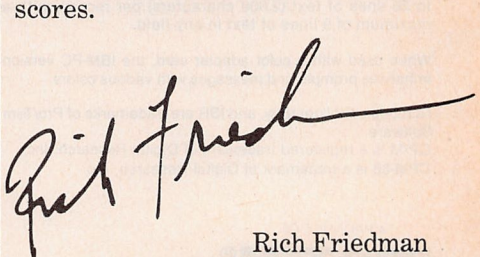
Although colleges are slow to admit it, admission officers place a lot of weight on test scores. Under pressure from students, parents, Ralph Nader, and the Federal Trade Commission, the Educational Testing Service recently reversed its position and conceded that "SAT scores can be significantly improved through careful preparation and systematic coaching."

There are currently more than 10 microcomputer software packages—ranging in price from $49 to $1450—that help a student prepare for the SATs. One company, Krell Software Inc., offers a money-back guarantee if test scores don't improve by at least 70 points after the student uses its programs a minimum of 6 hours. To test the validity of this claim and compare the merits of three popular SAT software coaching programs, we asked Peter Owens, a professor of English at Southeastern Massachusetts University, to forget most of what he has learned and become a high school student again.

Owens, who holds a PhD in Education from Harvard University, jumped at the chance and enlisted the aid of Rufus Winsor, a professor of mathematics, to evaluate the math sections of the programs. After a few hours of work with one of the programs, Owens told us, "I was considerably less anxious about test questions and much more comfortable with the testing environment. Sample SATs seemed less intimidating and less mysterious after practice on the computer."

Both Owens and Winsor agreed that a good SAT preparation program will lessen students' test-taking anxiety by familiarizing them with the types of questions asked. As Owens put it: "I became comfortable with a certain level of wrong answers and was less prone to the irritation, anger, frustration, and helplessness they can cause."

All this is good news, of course, for those who can afford a computer system and the necessary software. But for those who can't, it's merely one more example of the rich getting another advantage over the poor. Maybe it's time college admission officers took another hard look at whether too much significance is given to SAT scores.



Rich Friedman
Managing Editor

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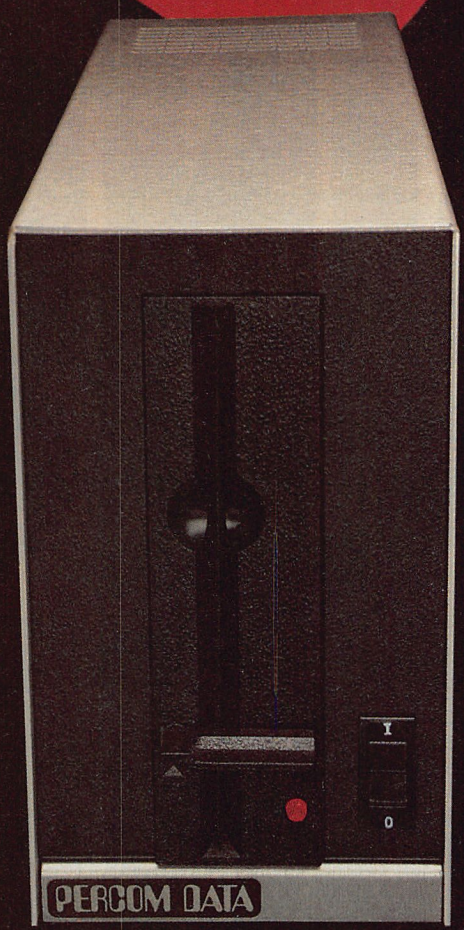

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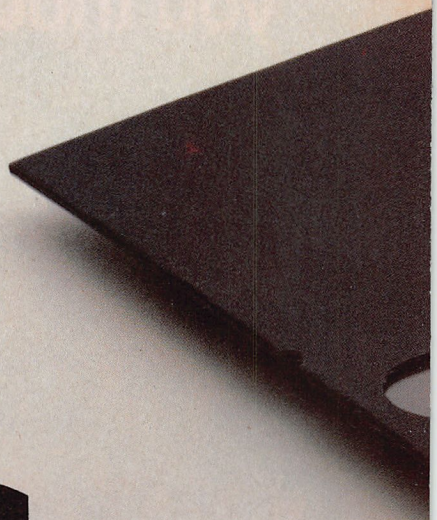

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A disk is built with certain safeguards. The technology is widely known. That's why most disk makers offer guarantees that the product you receive comes to you error free. We at Memtek Products are concerned that the minidisk remains error free, once put into use. *Every* time you use it. After exposure to dust, cigarette smoke, fingerprints, even wear caused by your computer. And so, we have built safeguards around the disk, as well.

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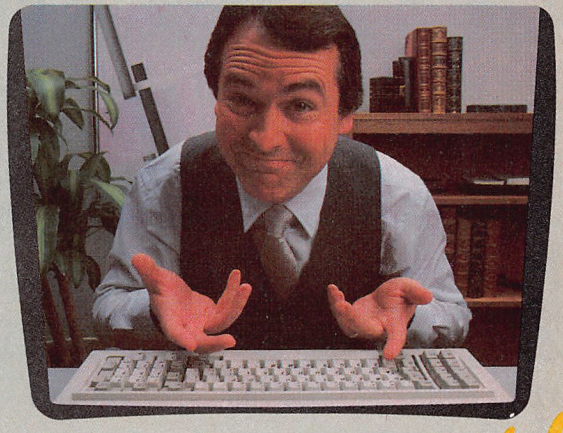

VisiWord!

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Computing Careers
Dear Editor:

"Careers in Computing" (June 1983, page 124) was a godsend. It was the first concise, in-depth article I have read that addresses the whole field of computing. As a student of computer science, I find the choices of schools, courses, and jobs mind-boggling. This article gave me a few fresh ideas.
Ted Markow
Topsham, ME

Falling Prices
Dear Editor:

In early December 1982, I purchased an Atari 800 for $799. In early April 1983, just four months later, I decided to move on to a bigger system and bought an IBM Personal Computer for $3300. The Atari 800 was then selling for $599. Currently, the Atari 800 is selling for a little over $300 (with rebate) and in the two months since I bought my IBM PC the price has fallen $600. Maybe if I wait long enough, I can update my system for free!
Donald F. Wallace
McLean, VA

Favorably Impressed
Dear Editor:

I just wanted to take a minute to tell you how much I enjoyed William Barden Jr.'s article "The Appliance Computer" (July 1983, page 58). It was refreshing and honest to the point of being bold. In his review of the troubles in computer paradise, I saw my own experiences reflected as well as the experiences of everyone I know who has bellied-up to his bank account and gotten into microcomputers. It's good to get this sort of straightforward talk out in the open where it has a chance and where, who knows, it just might have some pleasant repercussions. Computers can be wonderful fun but that doesn't mean they are invariably a tiptoe through the tulips.

That *Popular Computing* offers this sort of candid and conscientious writing speaks well of its character. I know I'm pleased and impressed.
Kenneth Dixon
Portland, OR

For Color Computer Too
Dear Editor:

I read with interest your recent review "Electronic Thinker Toys" (June 1983, page 161). I would like to call to your attention that many programs developed by the Learning Company, i.e., Juggle's Rainbow, Bumble Games, Bumble Plot, and Moptown are available in either cassette or disk format and require a 16K-byte RAM and Extended BASIC for Radio Shack Color Computer users.

The programs are being distributed through the Follett Library Publishing Company and have been field-tested in our school district. We concur with reviewer Molly Watt that each of these programs is excellent and most appropriate for elementary school usage. I believe it is important that your readers know that these programs are not available only for Apple computer users because many of your readers might use Radio Shack Color Computers.
Dr. Paul Kimmelman
Norton, OH

Liked Printer Series
Dear Editor:

David Kater's three-part tutorial on the Epson MX-80 printer (April, May, June, 1983) was a lifesaver—not because I own an Epson but because I own a Gemini-10 printer. I have high praise for the Gemini but the supporting documentation is very technical and not user-friendly.

Parts 1 and 2 in the series are applicable to the Gemini without editing. Part 3, which deals with graphics, may need instructions dedicated to the Gemini.

I commend Kater for his format and style, which walks the reader through a typical application. Many how-to documents could be enhanced by this type of presentation. How about a Part 4 to adapt the existing treatise to the Gemini?
Stan Campbell
Cincinnati, OH

Includes BASIC Program
Dear Editor:

I have one correction concerning William Barden Jr.'s column "Joysticks and Graphics Tablets" (June 1983, page 62). Each Color Computer graphics pad comes with an extensive BASIC program that provides full use of the supplied template including user-supplied additional menu functions. The source code for the program is in the manual. Any owner who receives a graphics pad without a tape should return it to his dealer. Extra copies of this tape are available to Radio Shack stores and dealers for distribution to users.
Roy J. Irvine
Buyer, Peripherals
Radio Shack
Fort Worth, TX

Farms and Computers
Dear Editor:

We noted your article "Computers On the Farm" (May 1983, page 81)—we were in two of the photos. Though the majority of your readers probably found the article quite interesting, those who farm apparently wanted more information. We have received several telephone calls from all over the United States from people who want more details on our use of computers in a cattle operation.

We are the new publishers of *AgriComp* (not mentioned in your article), the computer magazine for farmers written by farmers. We publish the only magazine available for this information-hungry group. Many of our readers have told us we have the most comprehensive information available on the subject. Our address is Agricomp, 103 Outdoors Bldg., Columbia, MO 65201, 314-443-4316. Thanks for keeping your readers up to date on farm computing.
John and Lesa Beckett
Aurora, MO

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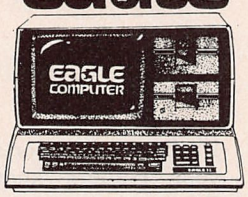

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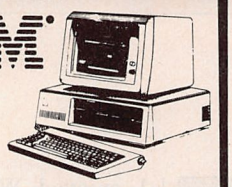

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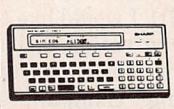

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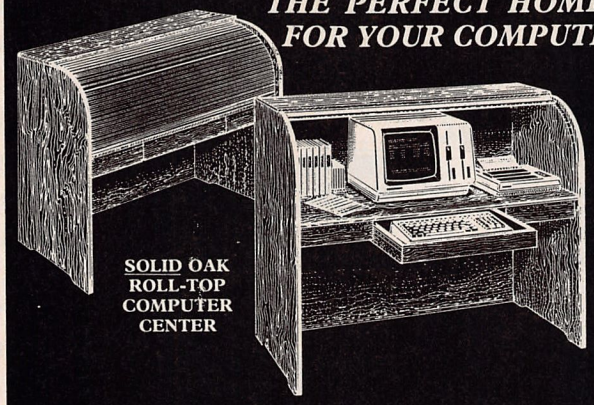

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LETTERS

A Simpler Solution

Dear Editor:

I believe I have a simpler analytical solution, other than the BASIC program presented, to a problem given in Recreational Computing (June 1983, page 208). One should not assume that computers or calculators are always better for solving a problem than alternative mathematical methods—a little calculus really makes a big difference. So put on your thinking cap before solving a problem. Here's my solution:

For the problem as given,

$$\begin{aligned} \text{AREA} &= A \times B \\ \text{COST} &= 5 \times 2 \times A \\ &\quad + 4 \times 2 \times B \\ &= 400 \end{aligned}$$

Rearranging the second equation,

$$\begin{aligned} B &= (200 - 5 \times A)/4 \\ &= 50 - 1.25 \times A \end{aligned}$$

Substituting into the first equation,

$$\begin{aligned} \text{AREA} &= A \times (50 - 1.25 \times A) \\ \text{or} \\ &= 50 \times A - 1.25 \times A^2 \end{aligned}$$

Since a function is at a *maximum* when the first derivative is 0:

$$\begin{aligned} \frac{d(\text{AREA})}{dA} &= 50 - 1.25 \times 2 \times A \\ &= 0 \end{aligned}$$

Then:

$$\begin{aligned} A &= 50/(2 \times 1.25) = 20 \\ B &= 50 - 1.25 \times 20 = 25 \\ \text{AREA} &= 500 \end{aligned}$$

John W. Cross
Old Lyme, CT

John Cross has a valid point—to a degree. It is certainly true, as he states, that "One should not assume that computers or calculators are always better than alternative mathematical methods." It is not at all clear why anybody thinks that we are saying otherwise. Indeed, readers are routinely invited to send superior methods. The idea is to get people involved. And that means everybody, not just the minority who know calculus, or for that matter, the ones who know number theory (another field that Recreational Computing material draws upon) or any other field. I think that this last point of accessibility is the main point. It might interest readers to know, for instance, that one person from California wrote me regarding the very same problem to say: "If you had not posed this problem, I probably would never have been aware that (the maximum area results when) the total cost available for fencing is equally divided between the fencing in one direction and that in the other direction."

This is something that is missing from the usual maxima/minima problems of calculus, namely, the discovery process, the seeking of patterns. I use the computer as just one such tool in this process.

There is certainly irony in the fact that the particular problem cited by Cross actually exemplifies an even more popular concern in the mathematics community. That is, the overuse and overkill of calculus for problems where noncalculus or precalculus methods suffice. In this case, the function being maximized is quadratic, and it is a relatively simple exercise to find the unique extreme point (maximum or minimum) for such functions. Moreover, there is no need to do a derivative test (which Cross neglected to do, incidentally).

To paraphrase Cross: "One should not assume that calculus is always better than alternative mathematical methods." . . . **Dr. Michael W. Ecker, Contributing Editor**

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I've used my Commodore 64 for about a month now, but I am still baffled by the four function keys. The only reference to them in the owners manual is that they are programmable keys. I can't find any further information on how to use or program these keys. Can you help me understand their uses?
Bob Morgan, Gretna, LA

Strictly speaking, the keys are not programmable, but they can be defined within a program. You could, for example, include a definition of the function keys within a BASIC program. This would be done using the GET command. But before you begin using them for programming, you need to know how the computer recognizes the function keys.

The four keys represent F1 through F4 and, when used with the shift key, F5 through F8. The computer sees them as CHR$ codes 133 through 140. Here is a table of the function keys and their corresponding CHR$ codes (the unshifted keys use the odd-numbered codes and the shifted keys use the even-numbered codes):

```
F1—CHR$(133)
F2—CHR$(135)
F3—CHR$(137)
F4—CHR$(139)
F5—CHR$(134)
F6—CHR$(136)
F7—CHR$(138)
F8—CHR$(140)
```

If you are unsure about how all this works, type in this program:

```
10 GET A$
20 IF A$=CHR$(133) GOTO 40
30 GOTO 10
40 PRINT "TEST OK."
50 GOTO 10
```

Line 10 instructs the computer to retrieve the next key pressed and store it as A$. Line 20 is a conditional statement that makes the program branch to line 40 if the key pressed is F1. Line 40 is where that key's function is defined; it prints TEST OK.

If, on the other hand, any key other than F1 is pressed, line 30 instructs the computer to go back to line 10 and try again. This means that you could peck every key on the keyboard and nothing would happen until you hit F1. Finally, line 50 instructs the computer to repeat the process.

You can try all the function keys by replacing CHR$(133) in line 20 with another function key's CHR$ code. Or for that matter, you could use the CHR$ code for any key. For more information, look up GET in the index of your owners manual.

Of course, the only function this program defines for the function key is simply to print TEST OK. You can, however, define more complicated functions limited only by your imagination. Other uses of the function keys may be defined in commercial software packages.

I have a TRS-80 Color Computer. Can you tell me if any companies are making full-stroke keyboards for that computer?
Doug Petty, O'Fallon, MO

Although Radio Shack's Color Computer has a keyboard with a typewriter layout, its nonstandard keys have probably drawn more criticism than any other single feature of the computer. However, Radio Shack does not offer a means to upgrade the factory-installed keyboard.

A few third-party suppliers have begun to offer reasonably priced full-stroke keyboards for the Color Computer. But there is one problem: like most manufacturers, Radio Shack does not endorse third-party modifications. Once installed, a new keyboard would have to be serviced by the company that supplied it, and you could be faced with the problem of sending your computer to two different repair shops for service.

Nonetheless, a better keyboard for the TRS-80 Color Computer is desirable, and if this demand continues, more third-party companies will offer such products. Here are a couple of companies that offer full-stroke replacement keyboards for the TRS-80 Color Computer:

- Mark Data Products (24001 Alicia Pkwy. #207, Mission Viejo, CA 92691; (714) 768-1551) sells the Super-Pro Keyboard for $69.95. The Super Pro features a key layout identical to the original keyboard's.
- Micronix Systems Corp. (7 Gibraltar Square, St. Charles, MO 63301; (314) 441-1694) offers the Professional Keyboard for $69.95 and the Premium Keyboard for $89.95. The Micronix keyboard has a slightly different layout and includes four programmable function keys.

I have a complete TRS-80 Model I system as well as a smaller TRS-80 Model I with Level II BASIC and less memory. Can I connect the two units so I can use the smaller one to control the main unit? I'd like to have a keyboard and monitor upstairs where I can load, alter, and save data on the main system downstairs.
Jay Cox, Wayne, NJ

There is a way. If the distance is less than 100 feet, the two computers can be connected directly via their RS-232C serial interfaces. Radio Shack sells the necessary cables. If the distance is greater than 100 feet, you'll need a modem on each computer that will allow you to use a standard telephone line.

In either case, you also need two communications programs: terminal and host. Radio Shack's communications software offers both programs. Load the terminal program into the small system and the host program into the main unit.

This makes your small system a remote terminal, and anything you type in goes directly to the main, or host, system as if you had used its keyboard. The video monitor on the remote terminal would display what is sent back by the host system.

You should be aware of a few problems, though. First, although the text sent to the remote terminal will be identical to the text displayed on the host system, the screen formats will be lost. That is, any command such as PRINT @ that instructs data to be printed at a specific point on the video monitor will be lost, and the data will be scrolled. This could create displays that are impossible to understand. If, however, the pro-

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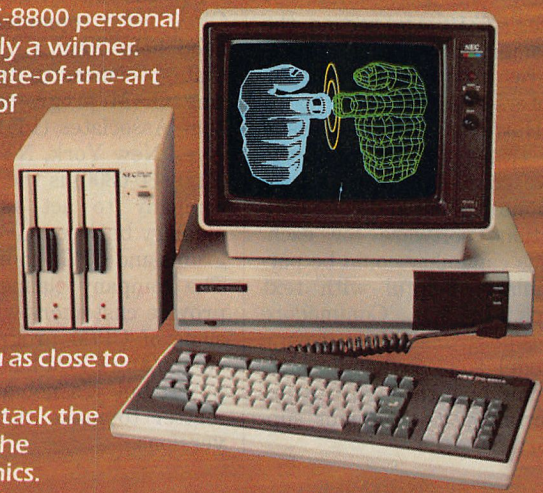

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gram running on the host system does not use screen formatting, the remote terminal will display an exact duplicate of what is shown on the host system's video monitor.

Another problem is obtaining an RS-232C interface for the remote terminal. Radio Shack no longer manufactures the Model I expansion interface that supports the RS-232C, and you may have a difficult time finding one. Here are a few compatible devices:

- The Holmes Expansion Interface System by Holmes Engineering Inc., Peripherals Division, 5175 Green Pine Dr., Murray, UT 84107; (801) 261-5652
- The MDX-2 by Micro-Design, Suite J, 6301 Manchaca Rd., Austin, TX 78745; (800) 531-5002
- The LNW System Expansion II by LNW Research Corp., Suite A, 2620 Walnut Ave., Tustin, CA 92680; (714) 641-8850

A direct-connect modem that connects to the cassette port of the Model I is available from Comstar Research, POB 771, Madison Heights, MI 48071; (313) 541-4840.

Is there a system that permits the printing of two characters in one space? I know it is possible to display the symbol á , for example, but can you print an accent or a diaeresis over a letter? MacGregor O'Brien, Frostburg, MD

The ability to print a character over another depends on both your printer and your program. Some printers (usually the more expensive letter-quality models) can backspace a single character space when given the appropriate command. This allows a computer to print a character, backspace, and print a diaeresis or accent over the character.

But the printer alone is not enough. Assuming you need this feature during word processing, your word-processing program must tell the printer what to do. Many word-processing programs let you embed specific printer codes within the text. This means you would type a letter, then the specific printer code for backspace, and finally the specific printer code for a diaeresis or accent.

Embedding printer codes in this way means that you may see some unusual characters in the text when it is displayed on your video monitor, but the printed copy will neatly show the desired effect.

I am in the market for a small home computer and am considering the Commodore 64. Recently, my business purchased a CBM (Commodore Business Machines) Model 8032. Is the CBM Model 8032 compatible with the Commodore 64? Leonard Goldman, Belle Harbor, NY

No. Even though the two computers are manufactured by the same company, two factors prevent their compatibility. First, they do not use the same microprocessor. The CBM Model 8032 uses a 6502 microprocessor while the Commodore 64 uses a 6510. And second, the memory-addressing procedures used by the two computers are different.

However, data can easily be transferred between the two computers with a telephone modem and communications software for each. This capability could be particularly helpful with text files. In fact, Commodore Business Machines uses a Model 8032 to handle electronic mail through Compuserve for its customer support.

Many advertisements I read lead me to think that CP/M-based software disks are interchangeable among all CP/M-based hardware. However, I read recently that disks are not interchangeable between different computers unless they have the same disk format. Could you advise me? Robert C. Ahrens, Cleveland, OH

The CP/M operating system is the de facto standard for small 8-bit computers, yet folklore surrounding its use is as great as the number of different CP/M-based computers on the market.

Four modules make up the CP/M operating system: the basic input/output system (BIOS), the basic disk operating system, the console command processor, and the transient program area. Of these, the BIOS varies to conform to specific computers.

A standard configuration for all computers does not exist. For the most part, the differences have to do with the way computers communicate with input/output devices such as keyboards, video monitors, printers, and disk drives. Therefore, the BIOS is tailored for each computer. The other three modules are the same on all CP/M systems. This means that a CP/M-based program will work on any CP/M-based computer *if* the program disk is formatted so that your CP/M's BIOS can read it.

Unless you have several CP/M-based computers, you need help from a company that specializes in transferring CP/M programs. Lifeboat Associates (1651 Third Ave., New York, NY 10028; (212) 860-0300) is the largest company to act as intermediary between CP/M programs and CP/M computers. The company claims it can provide customers with versions of CP/M programs to run on any CP/M-based computer, but it's not a simple matter to make these conversions.

What the company must do is translate between the various ways different computers write data to disks. While most personal computers use 5¼-inch floppy disks, the computer-specific formats of these disks vary widely in terms of the number of tracks per disk, the number of sectors per track, and the number of bytes per sector. Companies like Lifeboat use sophisticated equipment to reformat a CP/M program disk so that it can be read by the customer's particular computer.

For a fuller treatment of these concerns, see "The CP/M Operating System," February 1983 *Popular Computing*, page 102.

Can you help me find a three-dimensional computer-aided design (3-D CAD) program suitable for a microcomputer? Tom Posey, Clifton, TX

Two factors—memory requirements and costs—have kept 3-D CAD systems in the domain of minicomputers. The software needed to control sophisticated functions such as the rotation of a high-resolution drawing containing thousands of points requires large amounts of random-access memory (RAM) and is necessarily complex. As with all applications programs, the greater the complexity, the greater the cost. As a result, most 3-D CAD programs range in price from about $2000 to more than $70,000.

However, the affordable new 16- and 16/32-bit desktop computers, as opposed to traditionally expensive minicomputers, create a larger base of potential users for CAD software developers; this will undoubtedly make 3-D CAD practical for small microcomputers.

Only a handful of 3-D CAD programs written for microcomputers are available now. Here are a couple of products you might be interested in:

- *Engineering Software for*

Microcomputers ($28.50 from Kern Publications, POB 1029, Duxbury, MA 02332; (617) 934-0445) is a book containing a tutorial and listings of several 3-D CAD programs written in BASIC. Program disks for the IBM PC or Apple are available for $19.95.

•Space Graphics ($795 from Micro Control Systems, 143 Tunnel Rd., Vernon, CT 06066; (203) 872-0602) is a 3-D CAD package including software and a graphics tablet for the IBM PC or Apple.

I have an Apple II Plus computer. What changes do I need to make in order to use the program that appeared in David Kater's series "Programming Epson's MX-80 Printer" (April, May, and June 1983)? Gerald Heasman, Mississauga, Ont., Canada

Converting the program (complete listing in June 1983 *Popular Computing*, pages 148 and 150) is not difficult. To do this, change every occurrence of LPRINT to PRINT and add the following program lines:

```
1 I$=CHR$(9)
2 B$=CHR$(2)
3 PR#1
4 PRINT I$ + B$;
5 PRINT B$ + "80N";
1155 PR#0
```

Lines 1 and 2 simply label the two CHR$ codes to be used. Line 3 directs the output of the print statements to the parallel interface card, assuming it is in slot number 1. If you use the card in another slot, simply change the statement in line 3 to reflect the appropriate slot number.

The Apple parallel interface card intercepts CHR$ code 9 (Control-I) as a control-processing character, thereby nullifying its use in the MX-80 program. Line 4 overcomes this problem by changing the control-processing character to the arbitrarily chosen CHR$ code 2 (Control-B). Line 5 changes the 40-column default format used by the parallel interface board to an 80-column format.

Line 1155 redirects the output of all print statements to the video monitor.

I need a mailing-list management system for about 20,000 names and addresses, but I don't want to buy a hard disk. Is there a program that will allow me to place this information on two 5¼-inch disks? M. Redwood, Point Arena, CA

Most mailing-list management programs designed for two 5¼-inch disks will hold only several hundred names and addresses. This limitation is caused by the disks' capacity.

To approximate how much disk memory is needed for 20,000 names and addresses, let's say that a single record containing a first and last name, street address, city, state, and zip code requires 80 characters including all letters, digits, and punctuation. The amount of memory required to store such a mailing list is 20,000 times 80 or 1,600,000 characters—about 1.6 megabytes.

A typical 5¼-inch double-density floppy disk, depending on how it is formatted, can store about 180K bytes. This gives you about 360K bytes in a dual-disk system, and the operating system and mailing-list management program take up some of that space. Clearly, 20,000 names and addresses cannot fit on two disks.

However, if you do not need frequent access to individual records, you can manipulate a mailing list of this size without buying additional hardware by dividing your data into volumes. For example, to file alphabetically by last name, you place records A through D on one set of disks, E through H on another, and so forth. □

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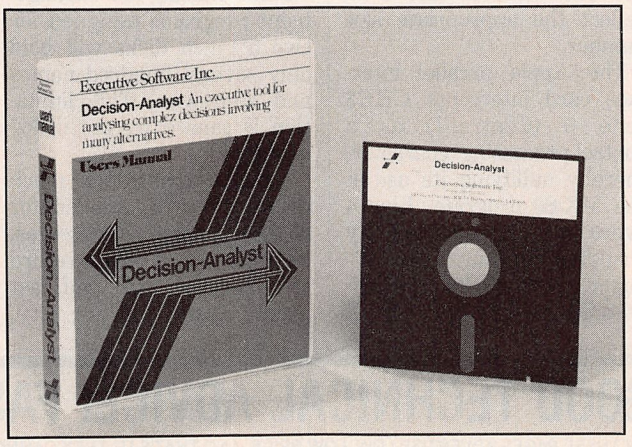

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Computer Tracks Hair Hues

In art class they teach you to mix yellow and blue to get green, but coloring is much more complex than that in the hair-styling business. A person's hair color can be changed subtly or drastically in thousands of unlikely ways. For example, hair colorists sometimes mix brown and blue to get ash brown. But because there are so many color combinations to sample, many hair-styling salons are buying a dedicated computer from West Germany—the Goldwell Cosmetics DMS 80-F.

The Goldwell computer stores up to 64,000 color combinations. The software not only takes the guesswork out of color matching but also eliminates the need for hours of trial-and-error strand testing. Toning, streaking, or completely changing hair color becomes a snap with the Goldwell computer, users say. Just feed the computer basic information about a customer's locks—color, texture, and the like—and the computer cranks out instructions complete with appropriate warnings about possible allergic reactions or potential damage from extreme color changes.

Priced at $3000, the Goldwell computer has been in common use in Europe for the last five years, but only a hundred or so are now in the United States, says Wolfgang Bell, export manager for the firm, which is based in Darmstadt, Germany. Bell notes that the American market is being developed slowly both because the computer is new here and because it's a rather costly item. Newer models should be smaller and less expensive, according to Bell.

Whitmans' Sampler—The Goldwell computer lets Andrea and David Whitman experiment with 64,000 hair-color combinations.

But those American salons now using the Goldwell computer are getting consistent, accurate coloring as a result. Three or four hours of color testing have been sheared to an hour or less, say David and Andrea Whitman of Whitman & Whitman Salon in Brattleboro, Vermont, the first Goldwell buyer in this country. Color formulas are stored on a cassette tape that is loaded into the computer's 10K-byte memory.

The Whitmans jumped at the chance to buy their Goldwell computer last year, anticipating a pay-back period of 18 months. That estimate turned out to be a little off. With the Goldwell at work, the Whitmans picked up 50 new customers, had time to do more color work faster, and figure that the machine paid for itself within six months. Just having state-of-the-art equipment helped snare new customers, they report.

"We can use it every time a customer walks through the door," David Whitman maintains. "You pick the target color and the computer does everything else for you." That includes generating special color formulas and dictating immersion time for roots, ends, or any other subtle color variation brought on by, say, sun or graying.

The computer replaces neither creativity nor a good eye for color, the Whitmans explain. "This is an aid to us," says Andrea Whitman. "It doesn't replace artistic ability. I use it as an artist would use paints. Once I have the formula, I know it's going to do what I want. The computer takes the guesswork out of it."

For that reason, the Goldwell computer also aids salons with hairdressers inexperienced at coloring. Mistakes are costly and embarrassing, and people new to coloring tend to be a little nervous at first. With the reliably consistent color provided by the Goldwell computer, inexperienced hairdressers can relax—and so can the customer.

A quick course in the operation of the computer is all that's needed. "It's simple to learn," says Andrea. "All eleven of our operators have learned to use it." On command, the formula and instructions zip out of a built-in thermal printer on a slip of paper no bigger than a receipt from a cash register.

Not resting on success, Goldwell's research and development labs are still in high gear. Bell reports that the company is testing a computer with more memory that also generates skin-care formulas and does the salon's accounting. So far this new model is available only in Europe, but one has been tested in Boston.

Despite Goldwell's low-key approach to the American market, the Whitmans believe it won't be long before more and more salons buy the machines. Mike Reuter of Ashland, Massachusetts, the Goldwell distributor for New Hampshire, agrees wholeheartedly when he reports, "Computers have definitely hit the beauty industry." □

Photograph by Hyam Siegel

Direct Selling Gets Slicker

Our report on Dynasty Computer Corporation's direct-sales strategies for microcomputers and peripherals ("Selling Computers Door-to-Door," April 1983 Update, page 19) elicited many letters from readers who wanted to know more about the multitiered sales organization based in Dallas, Texas.

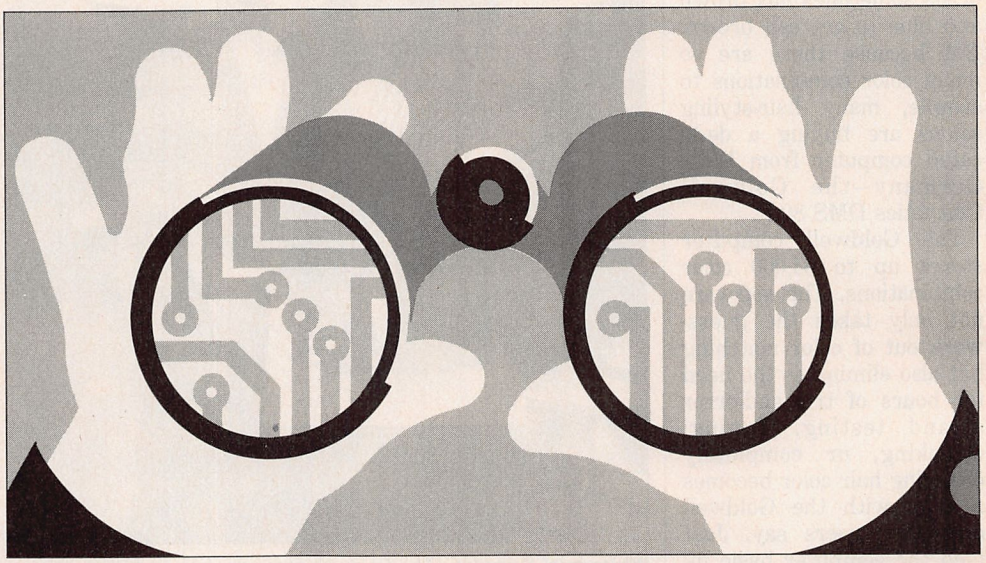
As that story indicated, Dynasty Corporation cannot be written off as an amalgam of bumbling door-to-door salesmen. Indeed, anyone who journeys to Dynasty's corporate headquarters expecting to find cackling yahoos in ten-gallon hats is in for a rude awakening: the company's tone is set by President Lawrence C. Hagerty, a mega-achiever who flies hot-air balloons for recreation and who, along with authors John Naisbitt (*Megatrends*) and Marilyn Ferguson (*The Aquarian Conspiracy*), airs his views about '80s culture and business trends in the prestigious Tarrytown Group. Hagerty's main achievement at Dynasty has been his aggressive assault on some of the Lone Star State's most powerful corporations: Texas Instruments, Radio Shack, and even Southwestern Bell.

Dynasty's product line now features the Smart-Alec II (a 64K-byte personal computer slugging it out in the TRS-80 Model III/Apple II league), the Smart-Alec Jr. (a nine-color, 16K-byte home computer priced at $129 to compete with the TI 99/4A), and a wide assortment of modems and auto-dialing telephones. Dynasty distributors are quick to point out that while Southwestern Bell charges $228 in Trimline phone rental fees over a five-year period, customers can purchase a Dynasty push-button model for under $60.

Hagerty's sales force is strongest in Dallas, Houston, Baton Rouge, Little Rock, and other cities in the Midwest that are exhibiting a post-recession demand for personal computer systems. Amos Favorite, a successful Dynasty distributor in Baton Rouge, knows that his potential customers need more hand-holding than the sometimes blasé residents of high-tech boomtowns like Boston. "I'm careful to explain that Dynasty's Smart-Alec II offers 80-column display and lowercase characters as standard features and still costs less than an Apple II," he says.

From as far west as Phoenix all the way to St. Louis, Hagerty's direct-sales teams are making soap-opera fans forget all about TV's *Dynasty* as they sell personal computers and peripherals in the most personal way possible: eyeball-to-eyeball in the privacy of someone's home. (Many Dynasty distributors eschew the door-to-door method, however, preferring to arrange appointments in their *own* homes where demonstrations can be set up and ready to go.)

For more information about Dynasty distributorships, contact Ms. Bobbie Weiss, Dynasty Computer Corporation, 14240 Midway Rd., Dallas, TX 75234; (214) 386-8634. □



Illustrations by Daniel Pelavin

Blowing the Whistle on High-Tech Snoops

"You Are a Target!" claims the headline, but running for your bulletproof vest isn't going to help. Instead, David Renwick thinks you should grab his *Technology Targets* newsletter, because the assault about which he warns is being waged in the international business arena and is designed to undermine America's technological leadership.

Technology Targets is a monthly strategy adviser for senior executives of American high-technology companies that, according to Renwick, "provides intelligence on what foreign governments and technical firms are doing to penetrate key high-technology industries in the U.S." The publisher goes on to complain that foreign firms aren't exactly fighting by the Queensberry Rules, either. "International competition is less and less based on traditional rules and regulations," he says solemnly. "Interference by national governments with market forces has proliferated to such an extent that it's now the rule rather than the exception.

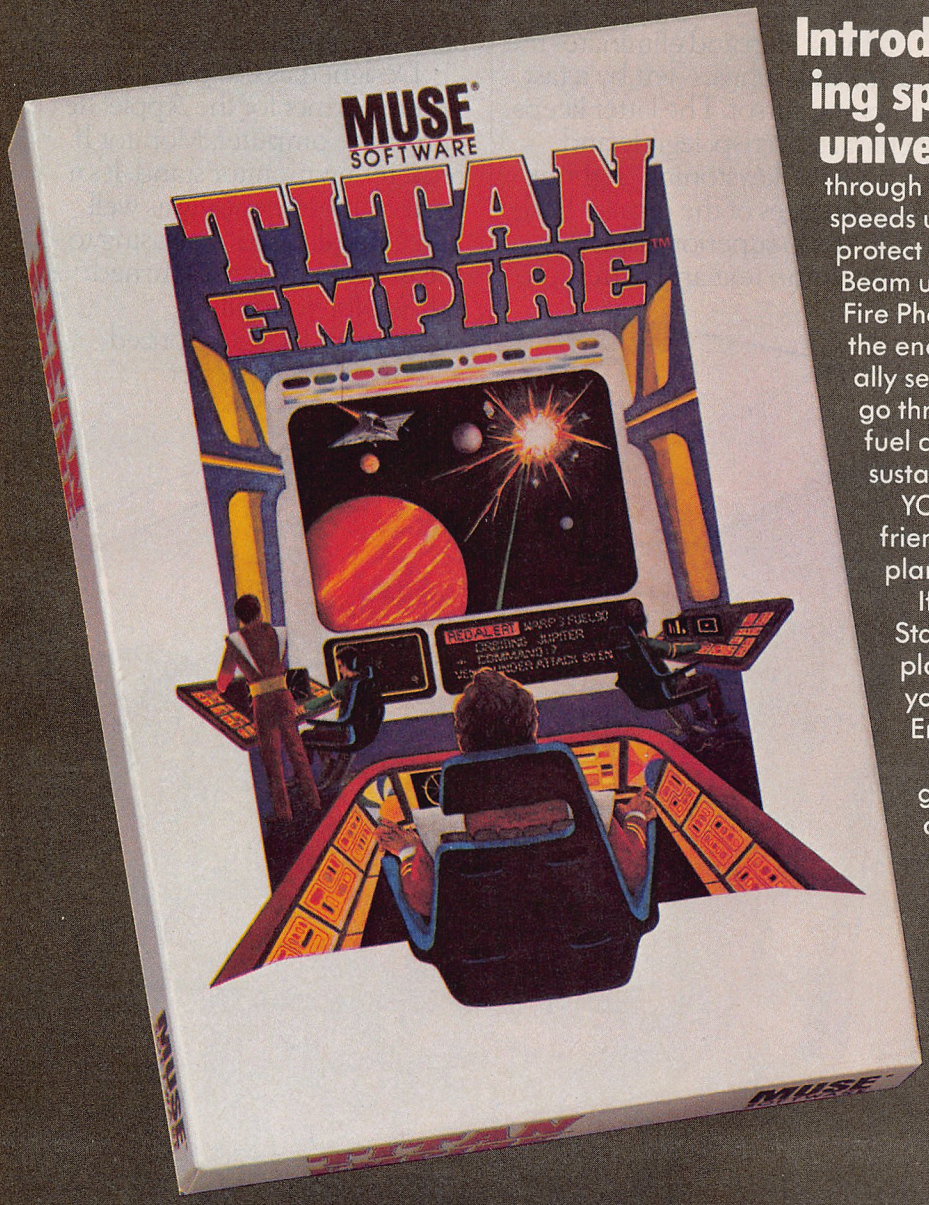
"The plain fact is that the advancement of technology is a critical factor in any developed nation's economic and political leadership in the world," Renwick continues. "If the U.S. is perceived as losing its technological leadership, there will be an adverse impact on U.S. influence around the world."

Renwick counts eight Western allies and all the Eastern Bloc nations among the hunters, including France, Japan, and Israel; he categorizes 17 industries (computer hardware, telecommunications, genetic engineering, aerospace technology, robotics, and nuclear power, to name a few) as targets; and he sees national policy, third-party deals, predatory pricing, and outright espionage as some of the many weapons.

So why isn't our government more aggressive in guarding our technological leadership? "There are elements in our government that are quite aware of the situation and are trying to help," Renwick says. "It's just that the government moves so slowly. You've got

Circle 104 on inquiry card.

Titan Empire.
It's light years ahead of its time.



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Command your Starship through space. Race through the universe at speeds up to Warp 9. Raise your Shields to protect yourself from heavy enemy attack. Beam up armies to strengthen your position. Fire Photon Torpedos and Tracking Missiles at the enemy. Set your Radar Range and visually see into space Sector by Sector as you go through the solar system. Control your fuel consumption and repair damages sustained in battle.

YOUR MISSION: To defend the remaining friendly planets and win back those planets already enslaved by the Titans.

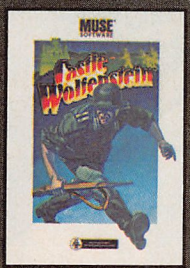
If you are a worthy commander of your Starship and you can take over all the planets in the shortest period of time your name will be entered into the Titan Empire Hall of Fame.

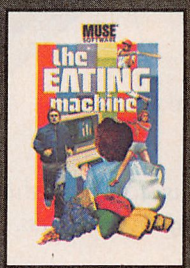
Titan Empire™ is an exciting space game that combines elements of video action and challenging strategy into a space adventure that is both fun and educational. Titan Empire™ contains a realistic solar system with the sun, nine orbiting planets and their major moons, plus enlightening educational information about each of them.

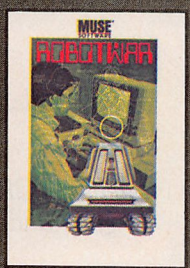
$34.95

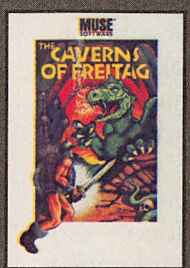
APPLE II+ & IIe
48K DISK DRIVE

Look for these other fine Muse Products.









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SOFTWARE

347 N. Charles Street, Baltimore, Maryland 21201 (301) 659-7212

Inside Apple

Vol. 1, No. 3

Apple's new Monitor II. A sight for sore eyes.

If you've been using a TV as a monitor, perhaps you can get a friend to read this for you:

Apple's brand new Monitor II will improve your vision.

It features all the latest ergonomic improvements in monitor technology.

For example:

Studies have shown that the leading cause of eye fatigue for computer users is lack of contrast between the displayed characters and their background.

So we designed the Monitor II around a high contrast green phosphor CRT that provides an extremely dark background. That means you can read text at a lower brightness. And that means you can be more productive — working longer and more comfortably.

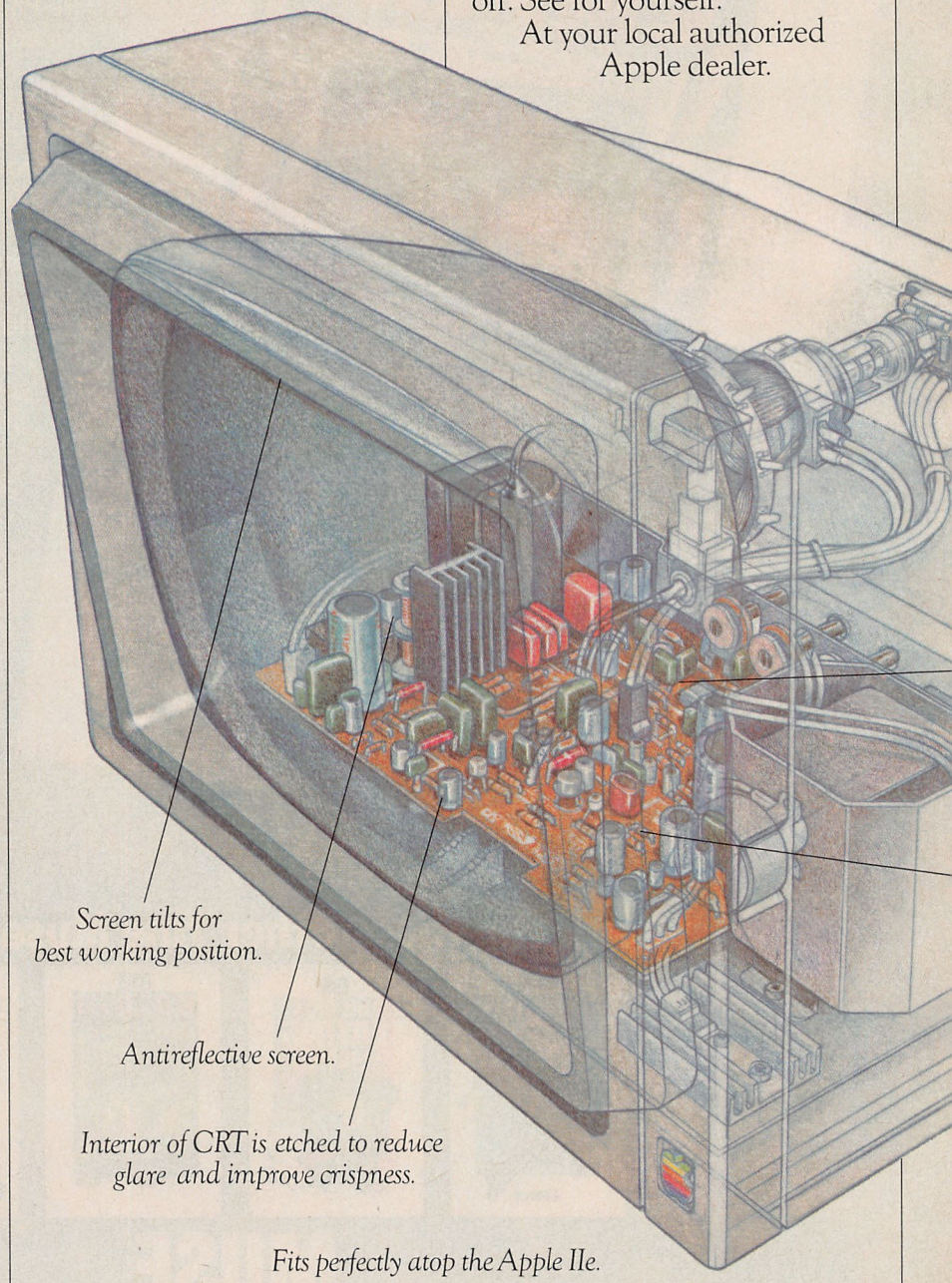
Toward that same end, we also gave Monitor II a tilt screen. So you can angle it perfectly for your working position, without scooting your chair around or sitting on phone books.

And we made that screen antireflective to reduce glare from ambient light.

Monitor II also features a high bandwidth video amplifier and a high tolerance linearity circuit. The former keeps characters from smearing on the screen and eliminates the annoying "ghosts" left by a fast moving cursor. The latter keeps characters crisp, legible and prevents "keystoning" right up to the edges of the display. Both add up to superior display of 80-column text and extremely accurate graphics.

Designed as the perfect system partner for the Apple® IIe Personal Computer, Monitor II requires no monitor stand. It's a perfect fit, aesthetically as well as technically. So it's pleasing to the eye even when it's turned off. See for yourself.

At your local authorized Apple dealer.



Now Apple plots color.

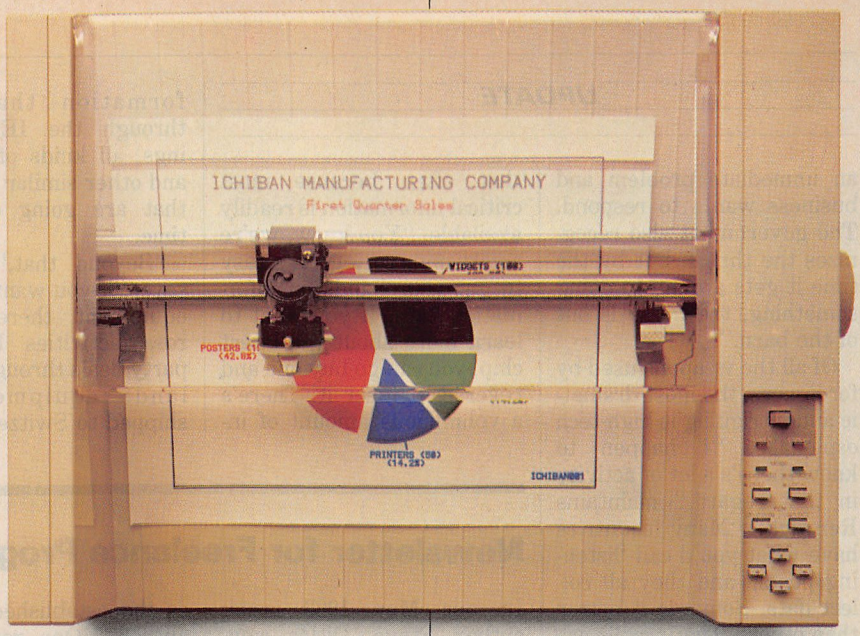
Since color graphics are becoming ever more important in business, we've been hearing more and more calls for a color plotter as reliable as an Apple.

Here it is:

Apple's new Color Plotter can generate all kinds of presentation graphics, engineering drawings or anything else you have to illustrate in up to eight brilliant colors.

And it can perform its art on any size paper up to 11" x 17." Or, with optional transparency pens, it can draw right on transparent film for overhead projection.

Measuring just 4.8"H x 16"W x 12"D, it's the smallest four-color, wide bed color plotter you can buy — about half the size of conventional flatbed plotters. So it takes up less space on your desk and can easily be moved to someone else's desk.

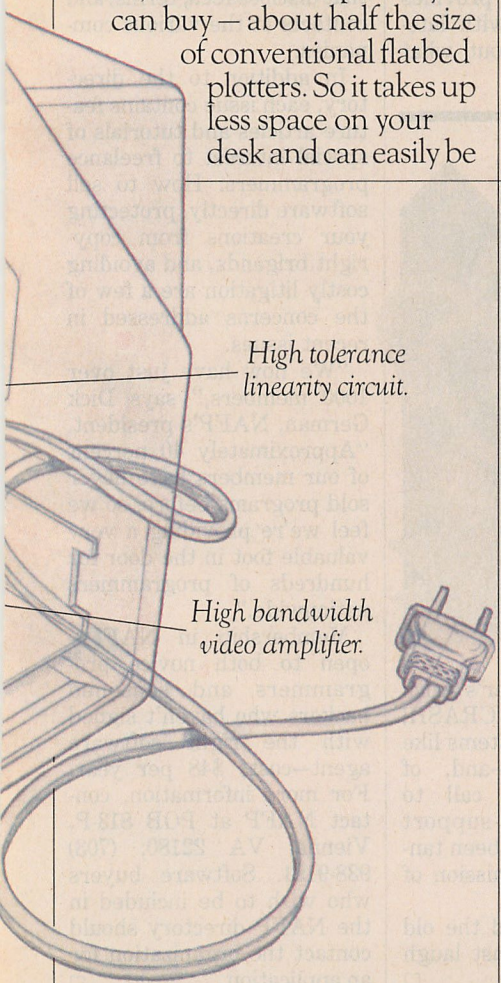


There are two color plotter accessory kits to choose from to assure a perfect marriage with your Apple II or IIe, or Apple III.

Each kit comes with eight color pens — red, blue, green, black, burnt orange, gold, violet and brown. Plus a starter package of plotter paper. Plus all the manuals, documentation and cables appropriate to your particular kind of Apple. So you can get up and coloring right away.

Apple also offers a complete selection of 24 different pen packages — so you can choose whatever colors you need in a variety of widths for a variety of applications and media types.

As you might expect, all of the above is available at many of our authorized Apple dealers.



Carry on with AppleCare℠ Carry-In Service.

No matter how long you've owned your Apple system, you can now get a long term service contract at a very reasonable cost.

AppleCare Carry-In Service is a service plan that will cover most Apple-branded components in your system for one full year.

It covers an unlimited number of repairs and is honored by over 1500 authorized Apple dealers nationwide.

Apple-trained technicians assure you of the highest quality service, fast — in most cases less than 24 hours.

AppleCare Carry-In Service is ideal for anyone who needs to know ahead of time the cost of maintenance for their system.

So check out the details — you'll find it's the lowest cost health plan an Apple can have.

Apple Computer Inc., 20525 Mariani Ave., Cupertino, Calif. 95014. For the authorized dealer nearest you, call **(800) 538-9696.** *© 1983 Apple Computer Inc.*

AppleCare is a service mark of Apple Computer Inc.

Circle 122 on inquiry card.

an immediate problem and business wants to respond. The government also recognizes the threat, but by the time it gets around to doing something, the horse is out of the barn."

Of all the weapons used by foreigners, the most dramatic and intriguing is high-tech espionage. "I happen to know there's a lot of activity in that regard," maintains Renwick. "Many countries have what you'd call 'listening posts,' and they all collect data. Some do it better than others. The Israelis are very good at it, the Japanese are outstanding, and the French are pretty active."

Can subscribers to *Technology Targets* expect to read about these clandestine efforts? "If there were a juicy tidbit, I'd certainly be tempted" to print it, says Renwick. He feels, though, that theft is not practiced that often because most critical information is readily available. "You know, we're a very open society. It's easy to get your hands on information here. If you want to learn more about the latest chip, you can go buy one and reverse-engineer it. There's a voluminous amount of information that comes through the IEEE meetings, all kinds of seminars, and other similar gatherings that are going on all the time.

"Beyond that," Renwick says, "if you want a piece of equipment, there are sub-rosa activities like third-party deals through Switzerland: equipment gets shipped to Switzerland then is moved to Czechoslovakia, for instance. The U.S. government is very active right now in trying to shut that down."

Charter subscriptions to *Technology Targets* cost $500 a year; those interested in learning more about the newsletter should write Regency and Associates, POB 808, El Toro, CA 92630 or call (714) 859-4608. □

Newsletter for Freelance Programmers

In our May 1983 issue, author Steve Ditlea analyzed the careers of software superstars such as Mitch Kapor and Fernando Herrera and gave a few pointers on how to negotiate with software distributors ("Marketing Your Software," page 99). But what about the fledgling programmers out there who don't get their calls returned as promptly as the established software authors? One resource for programmers who haven't been around the track before is *Software Market Letter*, a monthly newsletter that comes to your mailbox as soon as you join the National Association of Freelance Programmers (NAFP).

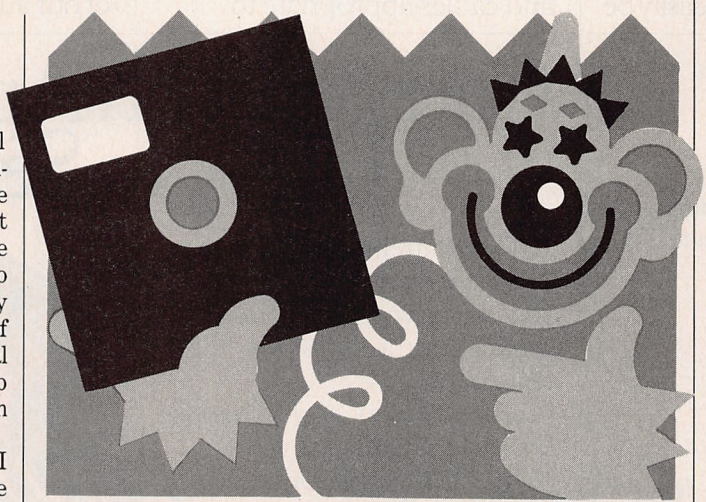
The newsletter provides NAFP members with late-breaking news about what kinds of software are in demand, which distributors are in a buying mood, and how to land your first freelance programming contract. A special feature of each *Software Market Letter* is its "Directory of Software Buyers," which is updated monthly and includes buyer profiles that disclose fees, terms, and contacts at the various companies.

In addition to the directory, each issue contains feature articles and tutorials of special interest to freelance programmers. How to sell software directly, protecting your creations from copyright brigands, and avoiding costly litigation are a few of the concerns addressed in recent issues.

"We now have just over 1000 members," says Dick German, NAFP's president. "Approximately 40 percent of our members have never sold programs before, so we feel we're providing a very valuable foot in the door for hundreds of programmers nationwide."

Membership in NAFP—open to both novice programmers and seasoned hackers who haven't signed with the right software agent—costs $48 per year. For more information, contact NAFP at POB 813-P, Vienna, VA 22180; (703) 938-9191. Software buyers who wish to be included in the NAFP directory should contact the organization for an application. □

DEC Smites April Fools



Several years ago, Digital Equipment Corporation installed a number of Decmate II microcomputers at selected test sites. The customers at these sites, who had the machines before they were available to the rest of the public, were given special deals as incentives to keep DEC informed about system bugs.

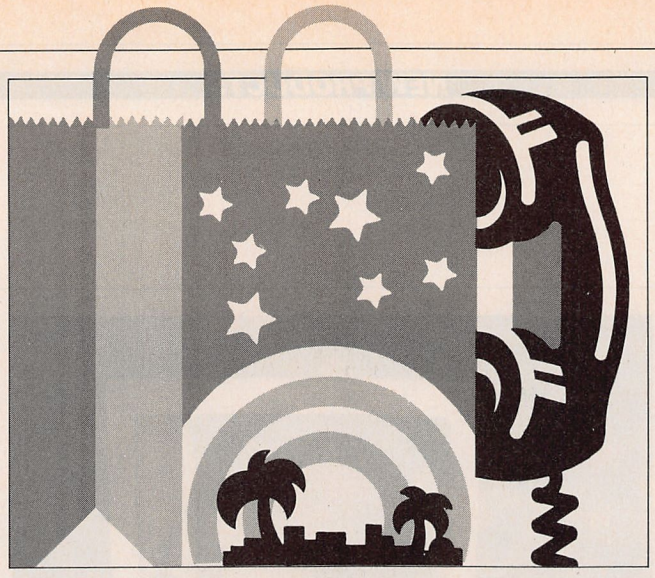
Because the Decmate II has proved to be one of the better word-processing systems around, the word-processing software provided to the test sites was of particular interest—especially to people who wanted to pad their incomes by selling bootleg copies to their friends or hoped to save some money by keeping a copy of the software for their own use.

But DEC had a surprise in store for these thieves. In a unique software protection scheme, DEC had embedded into the word-processing source code the statement IF DATE$ = APRIL 1, 1983 THEN DELETE ALL FILES.

All across the country, people with pilfered software were happily writing and editing away until the morning of this year's April Fools' Day. Then, CRASH! Down came the systems like houses of cards—and, of course, a phone call to DEC's customer-support hotline would have been tantamount to an admission of piracy.

It brings to mind the old saying about the last laugh being the best. □

Buy-Phone Blankets L.A.



Anyone who's ever lived in west Los Angeles knows how much energy—both human and automotive—can be expended simply getting from one point to another. But now there's Buy-Phone, a videotex service with all manner of listings: restaurant guides, movie schedules, even descriptions and prices of products being sold along Beverly Hills' ritzy Rodeo Drive. Best of all, Buy-Phone doesn't charge its customers for connect time, and there are no unwieldy passwords to worry about. All you need is a microcomputer, a modem, and a telephone; Buy-Phone's on-line advertisers pay the freight.

Buy-Phone's 11,000 listings can be called up by neighborhood. For example, if you live in Marina del Rey and want to see an 8 p.m. showing of *Return of the Jedi*, you simply type in a series of short codes to indicate city and movie and the computer displays the name of the nearest theater that's showing the film. If that particular theater is inconvenient, the computer goes on to give you the names of theaters that are progressively more distant from your home.

"When the UCLA kids and the movie-premiere throngs all converge on Westwood, it can be very frustrating trying to get box-office information by phone," says David Lappen, Buy-Phone's vice-president. "Using the computer, you can get the information you want instantly, saving you the irritation of 19 calls that net only busy signals."

Among Buy-Phone's many listings are 1600 pertaining to restaurants, which are indexed by such categories as nationality, price, and type of entertainment. "This way the casual browser knows that dinner at, say, Chasen's is going to have a certain ambience not found at a steak house," chuckles Lappen. And if La Scala restaurant appears to be out of your price range, you can access the Buy-Phone category for food to go.

Currently there are no plans to expand Buy-Phone's services beyond the west Los Angeles area, but if you're a computer owner living in the area bordered by Mulholland Drive, Western Avenue, LAX airport, and the Pacific Ocean, Buy-Phone is only a call away at 474-0270. For more information about Buy-Phone's offerings, write the company at POB 29307, Los Angeles, CA 90029 or call (213) 279-1074. □

StarLogic Announces Savings on IBM PC Compatible Disk Drives

5¼" Winchester Disk Subsystems from Interface Inc
Includes Winchester disk drive, cabinet, power supply, cable, controller, I/O adapter, and software (JEL) for 1.1 DOS.

5 megabyte Winchester disk drive	$1375.00
10 megabyte Winchester disk drive	$1575.00
15 megabyte Winchester disk drive	$1775.00

Tandon Internal 5¼" floppy drives
Standard sized drive plug-compatible with IBM PC

Single-sided drive—160K bytes	$165.00
Double-sided drive—320K bytes	$235.00
Double-sided drive—650K bytes	$315.00

(includes software patch to 1.1 DOS

IBM PC XT Disk Drives from Interface Inc
Dual floppy disk drives each with 362K bytes storage; both drives mount in "A" position $ 450.00
10 Megabyte Winchester Subsystem Slave compatible with IBM DOS 2.0 $1095.00

Add-on external drives from Interface Inc
Includes 5¼" floppy disk drive, cabinet, power supply and cable.

Standard sized 5¼" drives	
Single-sided drive—160K bytes	$235.00
Double-sided drive—320K bytes	$305.00
Double-sided drive—650K bytes	$385.00
(Includes software patch to 1.1 DOS)	
Half-height ThinLine 5¼" drives	
Double-sided drive—320K bytes	$285.00
Double-sided drive—650K bytes	$365.00
(Includes software patch to 1.1 DOS)	

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StarLogic
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All storage capacities are IBM Format
IBM is a registered trademark of IBM Corporation
ThinLine is a trademark of Tandon Corporation
JEL is a product of Tall Tree Systems
Prices are subject to change without notice

ALL FOR THE PC

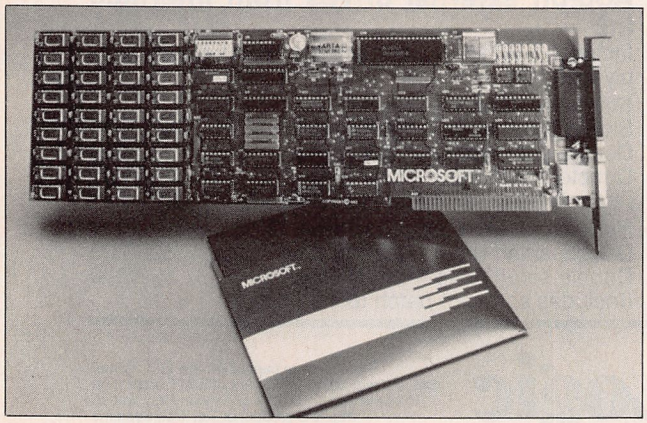
Making the System Work

Microsoft Corporation has announced an expansion card that adds four functions to the IBM Personal Computer. The Systemcard features a calendar/clock with battery backup, up to 256K bytes of random-access memory, plus serial and parallel interfaces. By combining all these features on one board, the Systemcard frees more of the PC's expansion slots for other purposes.

The Systemcard's parallel interface is Centronics-compatible and includes a print spooler buffer that lets you access your computer while it's printing a document. The card's asynchronous serial interface connects the PC to any RS-232C-compatible device. Disk emulator software included with the package enables the Systemcard's memory to mimic a high-speed disk drive. The calendar/clock features a set of software utilities. The Systemcard is completely compatible with the IBM PC and requires no translation software.

The 64K-byte Systemcard is priced at $475. A 256K-byte version costs $995. Documentation includes installation and operating manuals. More details are available from Microsoft Corporation, 10700 Northup Way, Bellevue, WA 98004. **Circle 200 on inquiry card.**

Microsoft's Systemcard for the IBM Personal Computer.



Apple-IBM Software Connection

Want the best of both worlds? Quadlink, from Quadram Corporation, lets you run most Apple II software on the IBM Personal Computer.

Quadlink is a multifunction board that translates the Apple's DOS (disk operating system) 3.3 into instructions an IBM PC can understand. The unit features 64K bytes of random-access memory, parallel and serial interfaces, plus a game port that's compatible with both the IBM PC and Apple.

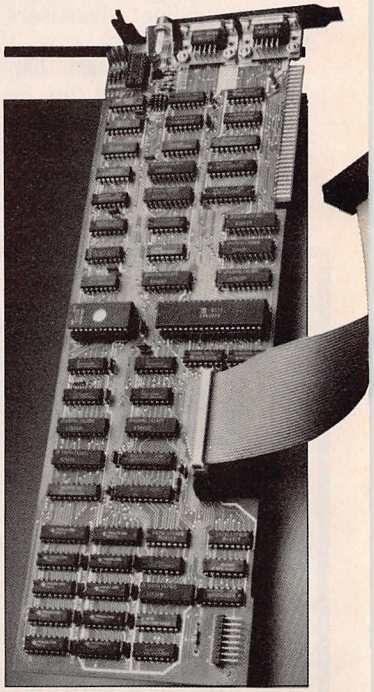
After installing Quadlink in one of the PC's expansion slots, you merely slip the Apple software into your PC drive and key in a single command to get into the Apple mode. There's no need to convert or reformat disks. Quadlink enables Apple software to access all IBM peripherals and enhancements and displays Apple programs—including high-resolution graphics—on any monochrome or color display. Quadlink retails for $680.

Quadram Corp., 4357 Park Dr., Norcross GA, 30093. **Circle 201 on inquiry card.**

A Mouse in Your House?

Mouse Systems Corporation's PC Mouse brings the power and flexibility of a "mouse" pointing device to the IBM Personal Computer.

The $332 PC Mouse works by translating mouse motions and button clicks into user-defined sequences. You can execute up to nine commands



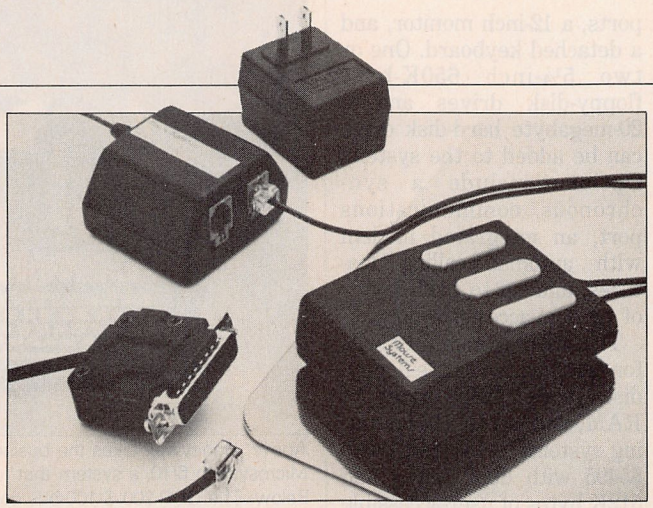
Quadlink puts an Apple II inside your IBM PC.

by clicking one of the mouse's three buttons from one to three times and assign as many as 15 key sequences to each button code. The key sequences perform exactly as if you had typed them in from the keyboard. The PC Mouse, according to the manufacturer, is compatible with virtually all IBM PC software.

The PC Mouse tracks motion without moving parts by optically counting grid lines printed on an aluminum "mouse pad." An internal microprocessor transmits position data at 1200 bits per second via a three-wire cable and interface box that connects to the computer's RS-232C port.

Included in the PC Mouse package is Draw, a graphics editor that takes full advantage of the mouse's powerful drawing capabilities. Also available is Mousewindow ($40), a software development system.

For more information, write Mouse Systems Corporation, 2336H Walsh Ave., Santa Clara, CA 95051.
Circle 202 on inquiry card.



The PC Mouse system for the IBM Personal Computer.

Express Yourself

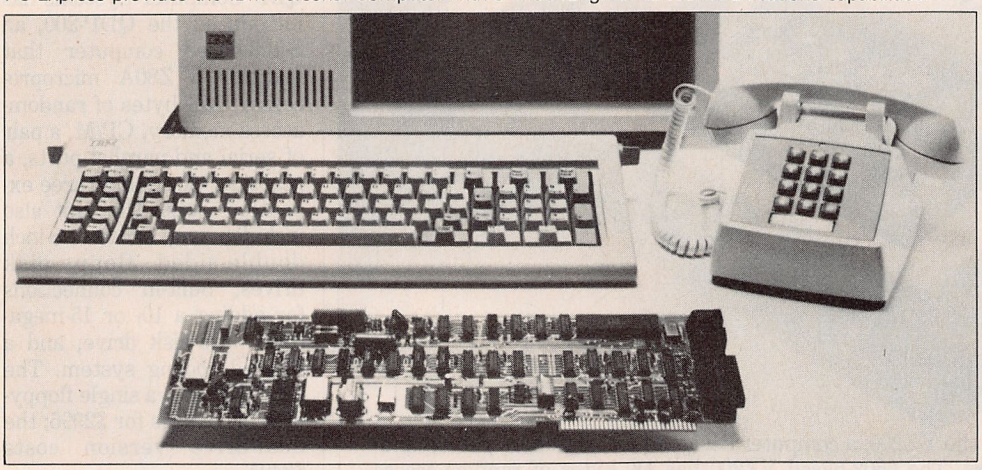
Intelligent Technologies International has unveiled two versions of a telecommunications system for the IBM Personal Computer. The PC Express transforms users' computers into multipurpose workstations capable of handling PC-to-PC communication, electronic mail, mainframe access, and automated telephone-management functions.

The PC Express package consists of a printed-circuit board that plugs directly into the IBM computer and a selection of disk-based tutorials and software. The package offers a wide choice of protocols, including synchronous and asynchronous settings. The PC Express I lets the PC communicate with standard asynchronous mainframes and microcomputers. The PC Express II provides 327X emulation and asynchronous protocols that support DEC VT-100/52 terminal emulation.

Both versions feature automatic dialing from a database telephone directory, automatic answering, and a full text editor for creating off-line messages. Each package also incorporates a 300-bit-per-second modem chip and an RS-232C interface.

The PC Express I retails for $895; the PC Express II costs $1295. Additional information is available from Intelligent Technologies International Corporation, 151 University Ave., Palo Alto, CA 94301.
Circle 203 on inquiry card.

PC Express provides the IBM Personal Computer with a wide range of telecommunications capabilities.



PC Power Management

The Power Director is a desktop power manager and voltage-transient protector for IBM and Osborne personal computers. The unit's four-stage automatic circuitry guards against AC line transients of up to 10,000 watts, excessive currents of up to 4500 amperes, and electromagnetic and radio-frequency noise. Nine lighted rocker switches, including a master control switch, give you complete fingertip control of each computer peripheral.

The Power Director comes in either IBM beige or Osborne gray and retails for $119. For more information, contact Computer Accessories Corporation, 7696 Formula Place, San Diego, CA 92126.
Circle 204 on inquiry card.

Welcome Honeywell

The Honeywell Microsystem 6/10 marks the mainframe and minicomputer giant's initial entry into the burgeoning small-business computer marketplace. The system is aimed at Fortune 1000 companies and other large organizations.

The Microsystem 6/10 is based on the Honeywell Micro 6, a 16-bit microprocessor that enables the computer to run the same GCOS operating system and much of the software used by Honeywell's DPS 6 minicomputer series. This compatibility permits users to operate the computer as part of a distributed system or as an independent unit. The Microsystem 6/10 also offers an optional 16-bit 8086 microprocessor that supports the popular MS-DOS and CP/M-86 operating systems.

Standard system features include 128K bytes of random-access memory (RAM), two asynchronous serial ports, a 12-inch monitor, and a detached keyboard. One or two 5¼-inch 650K-byte floppy-disk drives and a 20-megabyte hard-disk drive can be added to the system. Options include a synchronous communications port, an integrated modem with automatic-calling features, and up to 512K bytes of random-access memory.

The Microsystem 6/10 sells for $3995 with a single floppy-disk drive, 128K bytes of RAM, and the GCOS operating system; the system costs $5495 with dual drives and 512K bytes of user-accessible memory. The hard-disk version sells for $9995. The personal computing option, which includes MS-DOS, CP/M-86, and GW BASIC, costs $875.

For further details, contact Honeywell Inc., U.S. Marketing and Services Group, 200 Smith St., Waltham, MA 02154.

Circle 205 on inquiry card.

Above: Honeywell takes the business microcomputer plunge with its Microsystem 6/10, a system that features minicomputer compatibility. Below: The QDP-200 S-100-bus computer.

Computer for Beginners

Video Technology is offering the VZ200, a computer designed for beginners yet expandable for more advanced users. The 6502-based VZ200 has 4K bytes of random-access memory, 9-color graphics, and built-in BASIC. The $99.95 computer offers a full-size, movable-key keyboard and can use any cassette-tape recorder for data storage.

Options include a 64K-byte expansion module, joysticks, printer, light pen, modem, disk drives, monitor, and a full line of software. For details, write Video Technology Inc., 2633 Greenleaf Ave., Elk Grove Village, IL 60007. **Circle 206 on inquiry card.**

QDP-200 Business Computer

QDP Computer Systems has introduced the QDP-200, an S-100-based computer that features a Z80A microprocessor, 64K bytes of random-access memory, CP/M, a pair of serial and parallel ports, a real-time clock, and three expansion slots. The unit also includes one or two 8-inch double-sided floppy-disk drives, built-in connections for adding a 10- or 15-megabyte hard-disk drive, and a filtered cooling system. The QDP-200 with a single floppy-disk drive sells for $2995; the dual-drive version costs $3495.

Complete information is available from QDP Computer Systems, 10330 Brecksville Rd., Cleveland, OH 44141.

Circle 207 on inquiry card.

Circle 100 on inquiry card.

SPECTRAVIDEO™

SV·318
PERSONAL COMPUTER

"THE MOST BANG FOR THE BUCK"
—CREATIVE COMPUTING MAGAZINE*

COMPARISON CHART	SV 318	ATARI 800	COMMODORE 64
PRICE**	$299	$679	$595
INTELLIGENCE: ROM (READ ONLY MEMORY) BUILT-IN	32K	10K	20K
EXTENDED MICROSOFT™ BASIC BUILT-IN	YES	NO	NO
CP/M® COMPATIBILITY BUILT-IN	YES	NO	NO
MEMORY: RAM (RANDOM ACCESS MEMORY) BUILT-IN	32K	48K	64K
EXPANDABLE TO:	256K	NO	NO

**Manufacturers Suggested List Price as of April 1, 1983. CP/M is a registered trademark of Digital Research. Microsoft is a registered trademark of Microsoft Corp. Coleco is a trademark of Coleco Industries.

At the winter National Consumer Electronics Show, Creative Computing Magazine evaluated personal computers at practically every price level. Among them all there was one computer they reviewed as "astonishing." The new Spectravideo SV-318. The personal computer that can meet the needs of everyone in your family. It outthinks, outperforms, outplays its competition...for under $300. Compared to Atari 800 or Commodore 64, the SV-318 has more built-in intelligence (ROM) to let you do more. Built-in super extended Microsoft™ Basic language, the industry standard, makes it truly programmable. Built-in CP/M compatibility means access to over 3,000 of the most used business software programs. A built-in cursor control joystick makes editing easy and plays great arcade quality video games. (An optional adapter can plug you into the fabulous world of Coleco™ games). Spectravideo also delivers a low-priced and complete line of peripheral accessories today. Unlike some of our competitors, whose peripherals are always "coming soon." It takes an outstanding computer to outclass our competition. At under $300, nothing else even comes close. Today, discover the Spectravideo SV-318.

*April 1983

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Let the world know when you're on a coffee break. When hot liquid is poured in, one message disappears and another takes its place on the computer screen. Fascinating to watch. Big 10 oz. size. Fine quality white English porcelain. 10 day money-back guarantee if not completely satisfied. $8.95

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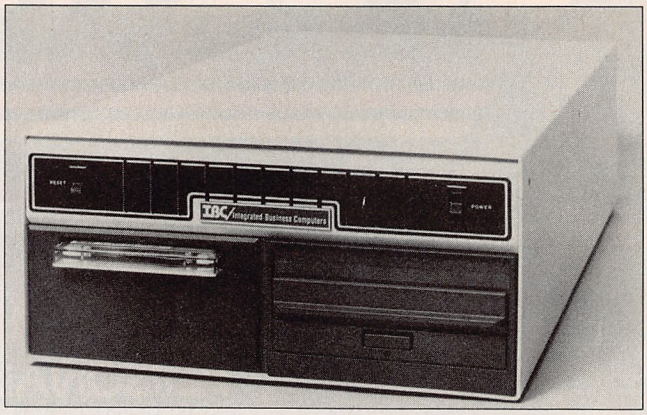
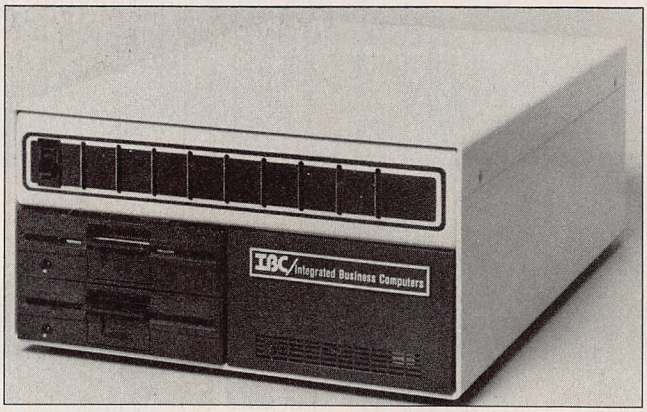


The Ensign and Middi Cadet, IBC's multiuser computers.



Ahoy!

Two multiuser microcomputers, the Ensign and Middi Cadet, are now available from Integrated Business Computers.

The Ensign is an extremely fast 32-user, five-microprocessor computer. The system's main processor is a 16-bit Motorola MC68000. Two additional microprocessors handle all serial input and output, freeing the main processor from communications tasks. Another microprocessor supervises all disk and tape operations. The remaining processor manages the system memory. The Ensign supports the Oasis-16 and Unix operating systems.

Ensign systems are available in either desktop or rack-mounted configurations and support up to 8-megabytes of main memory (up to 512K bytes per user). The Ensign also supports certain minicomputer disk and tape storage systems. An Ensign system including 16 serial ports, 512K bytes of random-access memory (RAM), 85 megabytes of hard-disk storage, a 1-megabyte floppy-disk drive, and a Centronics-compatible interface sells for $25,000.

The Middi Cadet is a low-cost, nine-user computer featuring a 6-megahertz Z80A microprocessor, 256K bytes of RAM, a 20-megabyte hard-disk drive, a 1-megabyte floppy-disk drive, 10 serial ports, one parallel interface, and an intelligent disk buffer. The Middi Cadet's memory can be bank-switched in 4K-byte blocks, enabling the system to change operating systems with the flick of a switch. The Middi Cadet sells for $7495.

Additional details are available from Integrated Business Computers, 21592 Marilla St., Chatsworth, CA 91311.

Circle 208 on inquiry card.

Hayes™

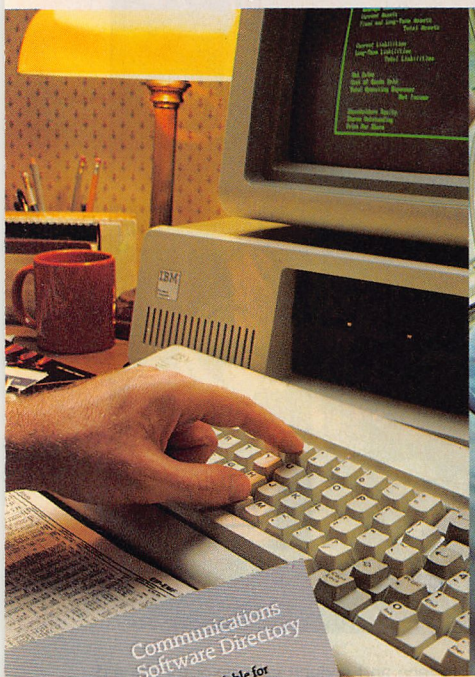
More micro software is written for Hayes than for any other modems!

Because Hayes, the telecomputing leader, continues to lead the way! With popular-selling modems that make telecomputing a breeze for beginners or professionals. And with sophisticated engineering that appeals to software developers.

Send for our free *Communications Software Directory.* It lists more than a hundred software programs written for Hayes modems by independent programmers. For diverse communication functions, from the practical to the fun. But all maximizing the advanced telecomputing capabilities of Hayes modems.

Whether you're collaborating on competitive strategies with offices in the field. Doing your gift shopping via computer. Or collecting and analyzing commodity or stock information. Let Hayes provide the superior communications link!

Mail the coupon today for your free copy of the Hayes Communications Directory. (Or pick one up at your local computer store.)



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Provides a comprehensive portfolio management system for active trader, money manager or investor.

Protects sensitive information sent over telephone lines so that no unauthorized person can decode files.

Permits use of normal telephone lines for accessing international Telex network.

THE FLIGHT PLANNER

Aviation software simplifies planning and increases safety.

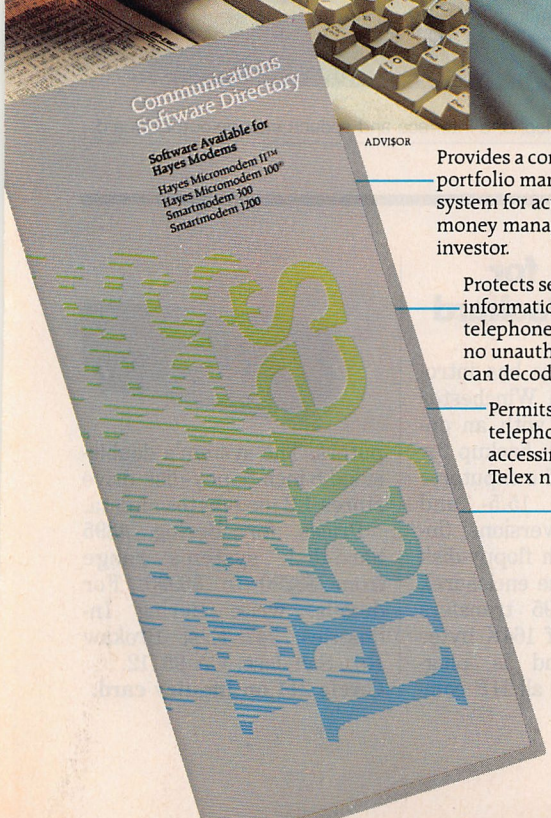
Automatically logs-on to networks, answers phone, saves incoming data, and allows it to be stored on disk, edited, and printed.

Transfers files between various micros, minis or mainframes.

Automatically answers phone in your name; receives, delivers messages.

TELE·GAMMON

Allows users to play backgammon with players at distant locations.



NOTE: More and more software is being written for Hayes modems everyday. Please let us know if you would like to have *your* program included in our next software directory.

Circle 59 on inquiry card.

Mail To: Hayes Microcomputer Products, Inc. Attention: Marketing Services, 5923 Peachtree Industrial Blvd., Norcross, Georgia 30092.

Name _____

Address _____

City _____ State _____ Zip _____

Please send additional information on:

- ☐ Smartmodem 300* **
- ☐ Smartmodem 1200* **
- ☐ Smartmodem 1200B* (plug-in board for IBM PC)
- ☐ Micromodem IIe* (for Apple computers)

P01

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*FCC approved in U.S.A.
**DOC approved in Canada.
©1983 Hayes Microcomputer Products, Inc.

Speak to Me

Compufone is a $995 telephone interface and speech storage/output device for S-100-bus computers. Approved by the Federal Communications Commission for direct connection to any standard modular phone jack, Compufone automatically originates and answers calls with a prerecorded message. The unit's voice digitizer lets you record speech from the telephone or from the board's mike-in or line-in connections. An onboard Touch-Tone decoder permits you to enter computer system commands from any outside telephone. Compufone applications include intelligent phone answering, voice mail systems, remote database access, inventory control, ham-radio repeater identification, alarm systems, and computer-aided instruction.

Additional information is available from Computalker Consultants, POB 1951, Santa Monica, CA 90406.
Circle 209 on inquiry card.

The Privecode phone system.

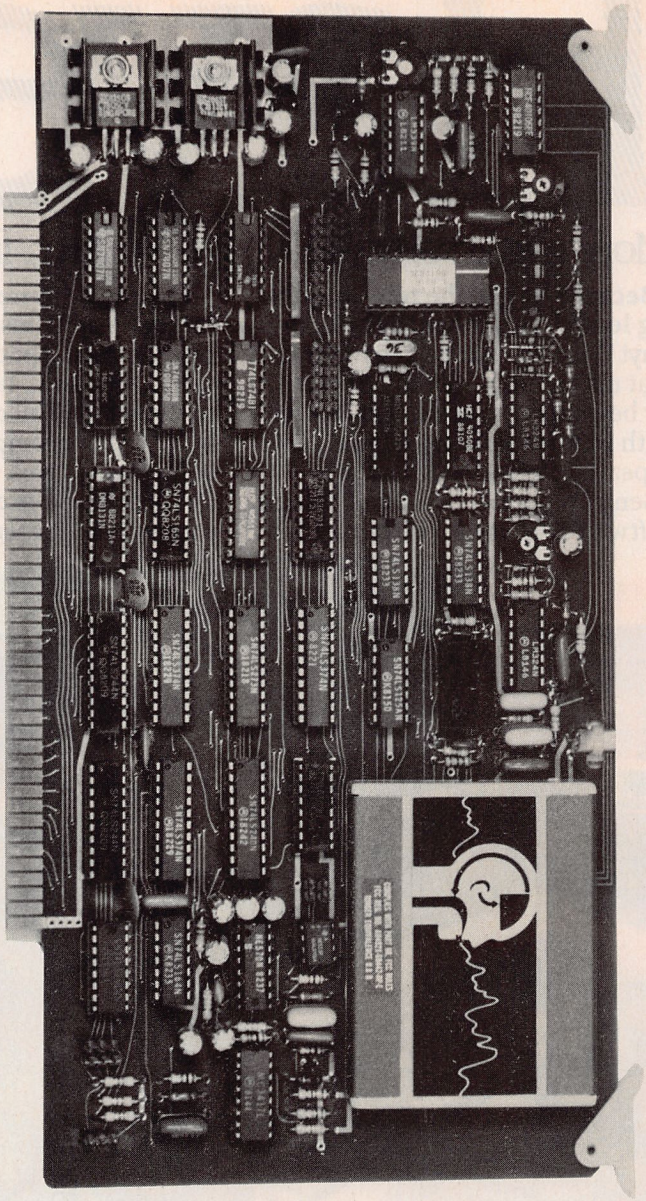
Put Them on Permanent Hold

Trying to dodge a bill collector? Don't feel like talking to Aunt Bertha? Despise telephone calls from high-powered salespeople? If any of these situations apply to you, then you'll probably be interested in the latest offering from IMM Corporation.

Privecode is a state-of-the-art telephone system that's designed to return privacy and peace of mind to the harried telephone owner. With the help of an onboard microprocessor, Privecode automatically intercepts incoming calls, blocking the ringing of all telephones under its control.

When a call is received, Privecode's synthesized female voice answers. It identifies the phone number the caller has reached and asks the caller for an authorized code. Numbers may be entered either verbally or from a Touch-Tone pad. If the caller enters a valid code, Privecode rings one of four preselected ring patterns and shows the code on an LED (light-emitting diode) display. You can then decide whether or not to answer. If the caller enters an invalid code, the system allows two additional chances to supply a correct code before automatically disconnecting the call. Future applications include remote control of lights and appliances from any phone. Privecode retails for $299.

For more information, write—don't call—IMM Corporation, 100 North 20th St., Philadelphia, PA 19103.
Circle 210 on inquiry card.



The Compufone telephone interface and speech storage/output board.

Hard Disk for Hewlett-Packard

Bering Industries has introduced a 5¼-inch Winchester hard-disk drive with an optional floppy-disk backup for Hewlett-Packard computers.

Available in 15.5- and 16.7-megabyte versions (including an 8-inch floppy-disk drive in the same enclosure), the Bering 4895 transfers data at a rate of 164K bytes per second and is plug-compatible with all HP computers. The system's double-sided 8-inch floppy-disk drive stores 1.2 megabytes of data.

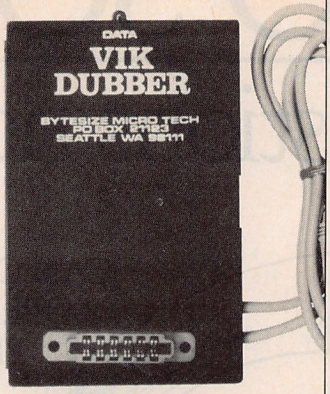
Prices for Bering 4895 hard-disk systems range from $3290 to $6990. For details, write Bering Industries, 747 East Brokaw Rd., San Jose, CA 95112.
Circle 211 on inquiry card.

Dub-a-Dub-Dub

The Vik-Dubber cassette interface enables VIC-20 and Commodore 64 users to save and load data with any standard cassette recorder. Priced at $34.95, the Vik-Dubber also offers the ability to link two recorders together for simplified backups, an audible cassette volume indicator and monitor, and internal filtering circuitry. The Vik-Dubber gets its power from your computer, so no batteries are required.

For detail, write Bytesize Micro Technology, POB 21123, Dept. BC, Seattle, WA 98111.

Circle 212 on inquiry card.



Vik-Dubber cassette interface for the VIC-20 and Commodore 64.

The Angel is an intelligent printer buffer with a "host" of features.

Heaven-Sent Help for Printers

Tired of waiting while your computer's printing? Angel, an intelligent printer buffer from Ligo Research Inc., enables you to input data during printing operations and access a wide variety of print controls.

The $295 Angel has a 64K-byte standard buffer capacity, an eight-key control panel for print-buffer control, and six LED (light-emitting diode) indicators that display system activities. Also included in the unit are RS-232C serial and Centronics-type parallel interfaces, a data-transfer control (rates range from 110 to 19,200 bits per second), and external switches for setting parity and data bit size. In effect, Angel converts serial signals to parallel and parallel signals to serial, eliminating incompatibility between computers and printers.

Angel's innovative page mode enables you to skip pages of text for partial printouts and reprint one or more pages in case the paper jams. A page-pause mode lets you insert single sheets of paper. Angel is compatible with IBM, Apple, TRS-80, North Star, and other computers, plus NEC, Diablo, Epson, and Centronics printers.

For further details, contact Ligo Research Inc., 396 East 159th St., Harvey, IL 60426.

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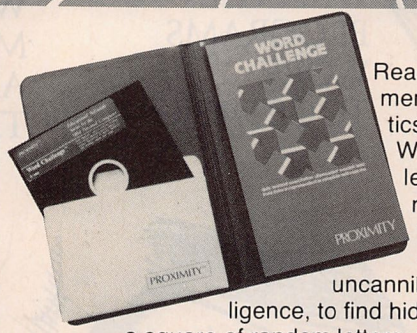
The intensity of Scrabble®, the excitement of Boggle®, the imagination of word search games...

WORD CHALLENGE™

The Ultimate Word Game.



Ready for some mental gymnastics? Take on Word Challenge. You'll race the clock with LEX, an opponent of uncannily human intelligence, to find hidden words in a square of random letters. (The sample square has 142 words.) Longer words score better points, so while you might enter "cap," "ape" and "tea," LEX is picking out "aster," "repast" and "sacred," all part of his remarkable 90,000-word vocabulary. But don't give up. You can select from 26 different skill levels, choose the square size (3 x 3, 4 x 4 or 5 x 5), time limit and a variety of scoring methods.

Word Challenge. Only $39.95 at your computer dealer. For Mastercard and Visa orders, call toll-free, 1-800-323-0023. In Florida, call collect, 305/566-3511. Or complete the coupon and send check or M.O. to: Word Challenge, Proximity Software, 3511 N.E. 22nd Avenue, Fort Lauderdale, Florida, 33308.

PROXIMITY™

Please send _____ Word Challenge Disk(s) for which I've enclosed $39.95 each (plus $2.00 shipping and handling). Florida residents please add 5% sales tax.

Check appropriate box.

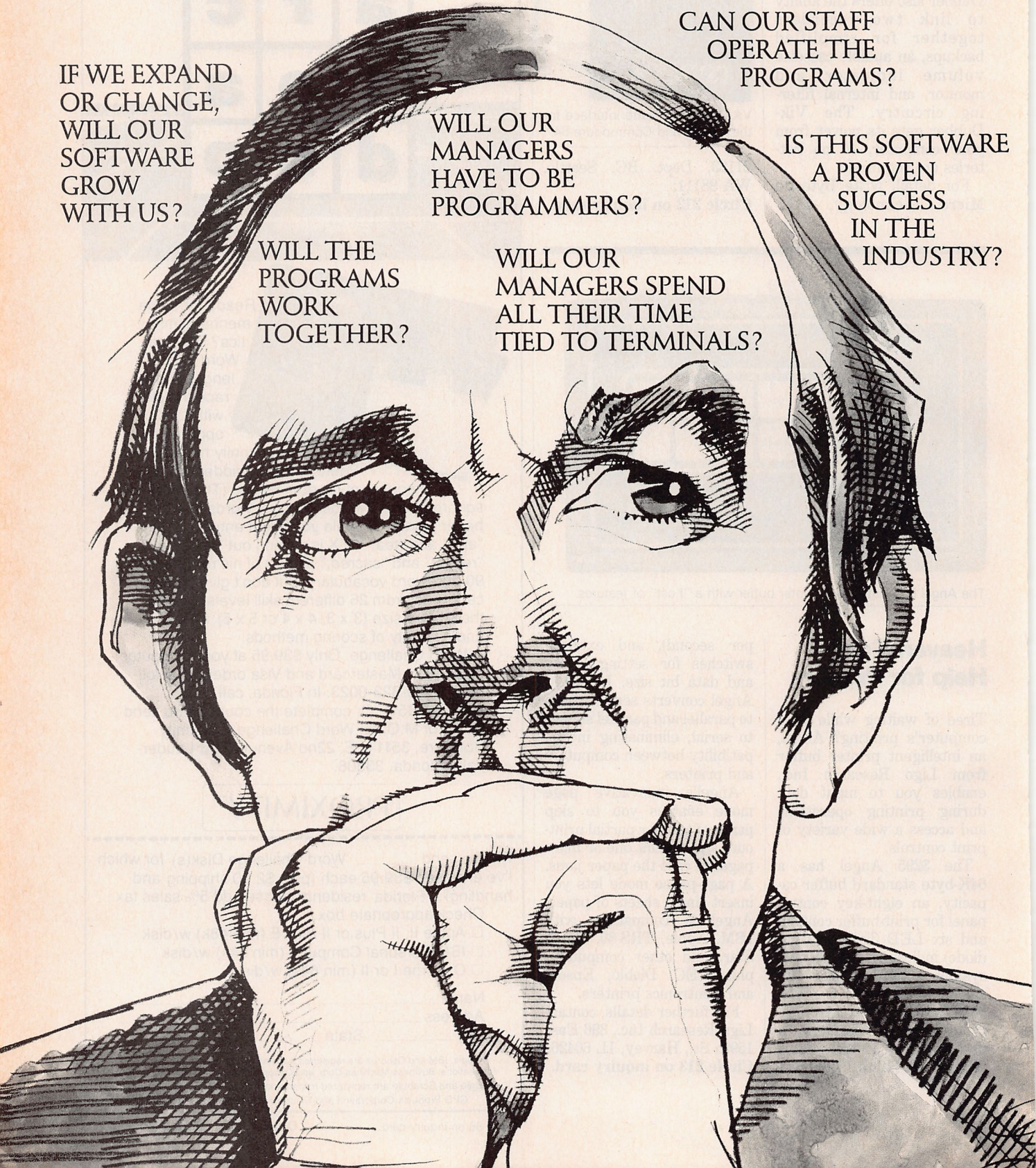
☐ Apple II, II Plus or II Plus E (min 48k) w/disk
☐ IBM Personal Computer (min 64k) w/disk
☐ Osborne I or II (min 64k) w/disk

Name_____
Address_____
City _____ State _____ Zip _____

Apple, IBM and Osborne are registered trademarks of Apple Computer, Inc., International Business Machines Corp. and Osborne Computer Corp., respectively. Boggle and Scrabble are registered trademarks of Parker Brothers Division of CPG Products Corporation and Selchow and Richter, respectively. POPC10/83

MICROPRO® SOFTWA

Ask these questions now, or you



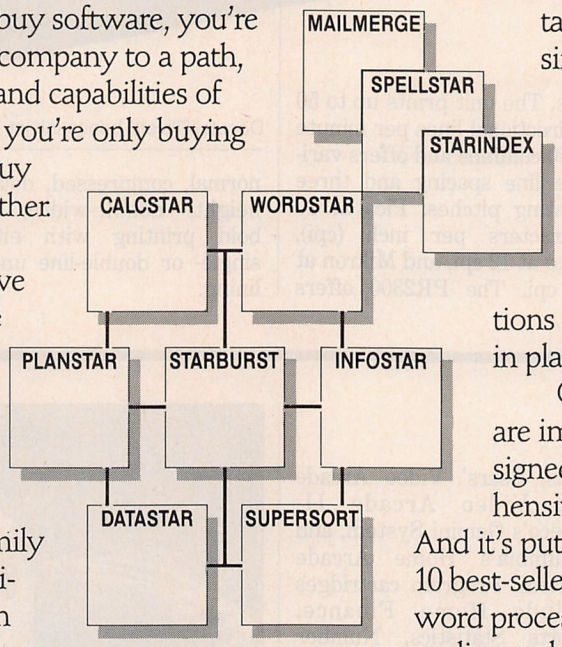
RE BUYER'S GUIDE

will have to answer them later.

MICROPRO HAS THE ANSWERS.

Whatever your current situation, there are factors in the software market that apply to you. Unfortunately, they tend to make choosing software a little intimidating.

For one thing, when you buy software, you're committing yourself and your company to a path, largely governed by the scope and capabilities of a software product *line.* Even if you're only buying *one* program now, when you buy more they should all work together. This makes your first decision rather far-reaching. It's expensive and time-consuming to change software; and sometimes requires buying new hardware as well.



MicroPro arms you for any eventuality with the most completely integrated family of business software in the business. Each of our wide selection of programs offers a range of capabilities from the simplest tasks (like memos) to the most complex office automation jobs. Their vast capabilities in Word Processing, "What If" Analysis, Financial Planning, Data Base Management, and more, can be instantly applied to any project; because all MicroPro programs work together. They share information, operating procedures, and perform complementary business applications.

Perhaps the most valuable option of all is the ability to build your own automated systems. With StarBurst,® a manager can set up simple step-by-step menus to guide staff through delegated tasks. Only MicroPro makes it simple enough to do yourself so you don't spend all your time doing mundane programming instead of creative managing. And only MicroPro makes it possible for you or another manager to change applications later—without a programmer, in plain English.

Obviously, in business, options are important. That's why we designed the most flexible and comprehensive software system for business. And it's put our programs among the top 10 best-sellers for years, with WordStar,® our word processing program, becoming the undisputed standard for the industry.

So don't waste any more time reading about how MicroPro's software answers can pave the way to a more successful future for you and your company. Go to your local computer store, and ask them to show you. For the dealer nearest you call (800) 443-0100 ext. 948.

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When you start with MicroPro, there's no stopping you.

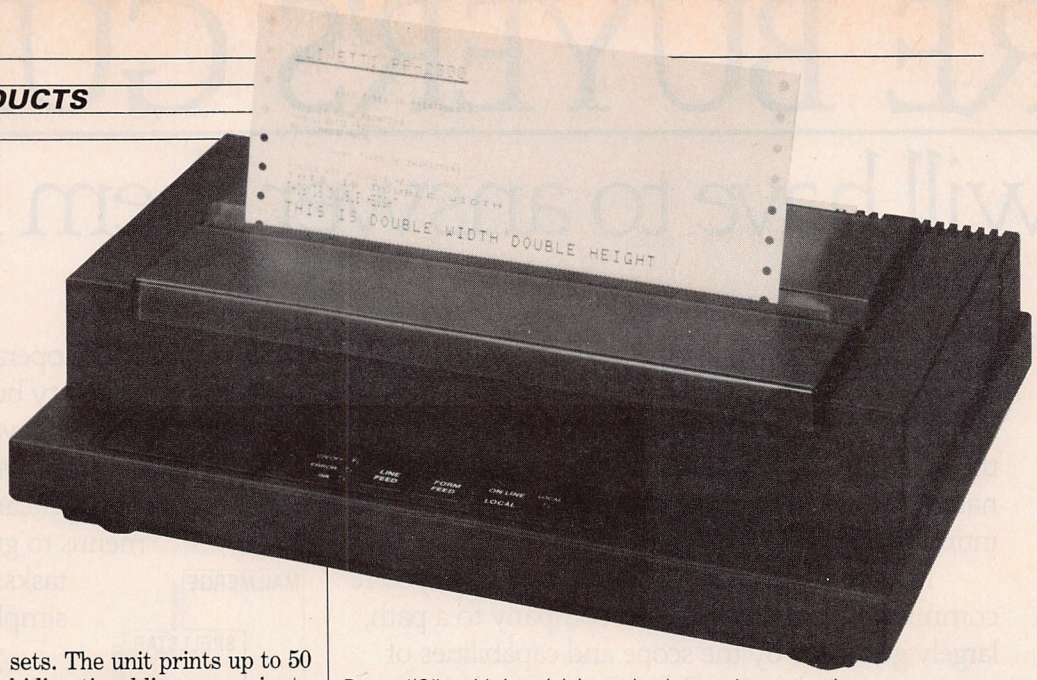
For name of the dealer nearest you, phone (800) 443-0100 ext. 948.
For more information write MicroPro, 33 San Pablo Avenue, San Rafael, CA 94903. (415) 499-1200.

Circle 141 on inquiry card.

You Don't Have to Pay It to Spray It

Ink-jet technology has long been recognized as a fast and almost silent—if somewhat expensive—method of printing documents on plain paper. Now Docutel/Olivetti Corporation has announced an ink-jet printer for $560. The PR2300 uses a single-jet print head to direct carbon particles onto standard paper in a 7 by 7 dot matrix. Electrical impulses sensitize the paper so the carbon particles form individual characters and graphics patterns when shot from the print head.

The PR2300 prints 96 ASCII characters along with seven software-selectable foreign language and symbol sets. The unit prints up to 50 bidirectional lines per minute at 80 columns and offers variable line spacing and three printing pitches: Pica at 10 characters per inch (cpi), Elite at 12 cpi, and Mikron at 15 cpi. The PR2300 offers normal, compressed, double-height, double-width, and bold printing with either single- or double-line underlining.



Docutel/Olivetti brings ink-jet technology to low-cost printers.

Write to Docutel/Olivetti Corporation, 155 White Plains Rd., Tarrytown, NY 10591 for details.

Circle 214 on inquiry card.

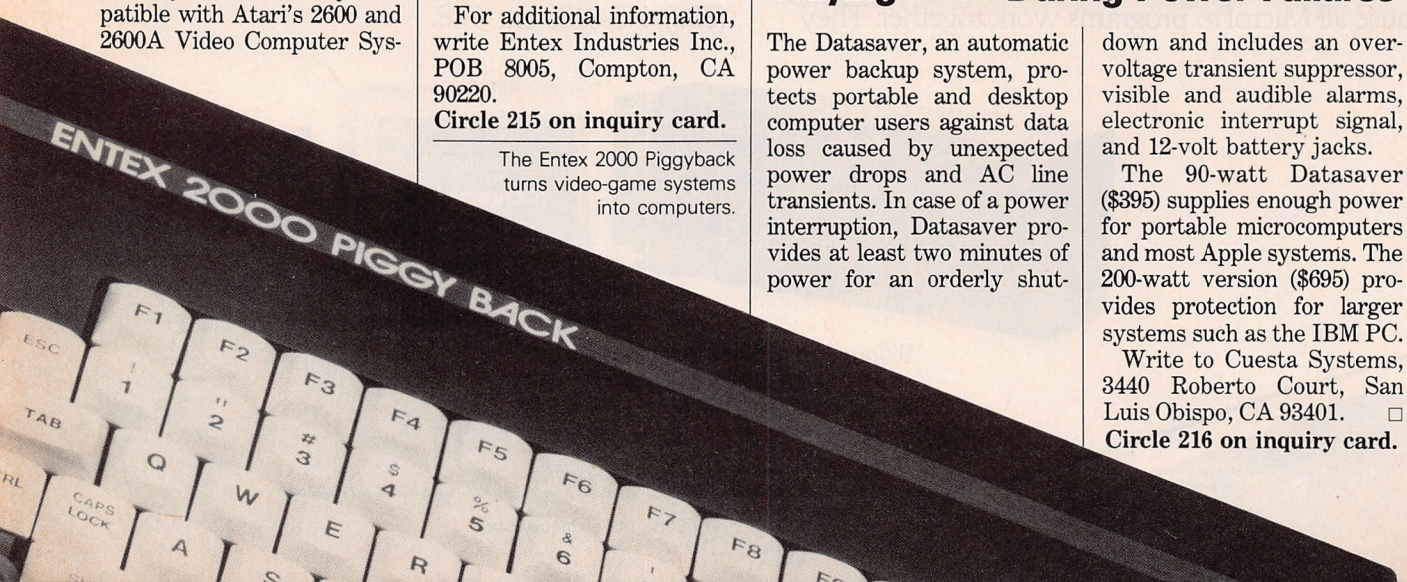
This Little Piggy . . .

Entex Industries Inc. has unveiled the Entex 2000 Piggyback, a computer keyboard for Atari, Coleco, and other video-game systems.

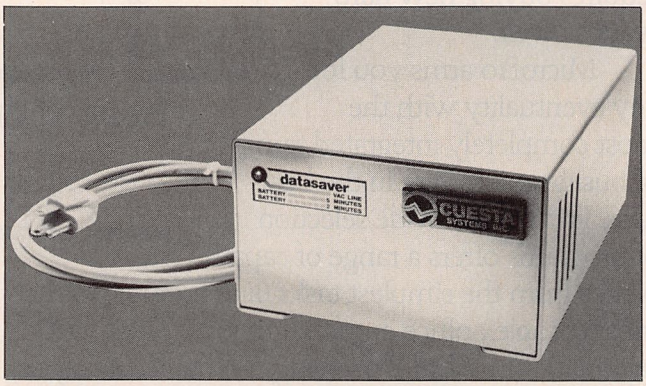
At a suggested price of $125, the Entex 2000 Piggyback features a full-size keyboard with 70 full-travel keys, including four cursor-movement keys and nine function keys, and 2K bytes of random-access memory (expandable to 34K bytes). The keyboard is directly compatible with Atari's 2600 and 2600A Video Computer Systems, Sears' Video Arcade and Video Arcade II, Coleco's Gemini System, and Columbia's Home Arcade System. Program cartridges include Home Finance, Sports Statistics, Number Games, BASIC Programming, and Speed Reading. Each cartridge retails for $35. Also available for the Entex 2000 is a peripheral expansion module (with an RS-232C interface) and a disk-drive controller.

For additional information, write Entex Industries Inc., POB 8005, Compton, CA 90220.

Circle 215 on inquiry card.



The Entex 2000 Piggyback turns video-game systems into computers.



The Datasaver automatic backup system provides power in a pinch.

Staying Alive During Power Failures

The Datasaver, an automatic power backup system, protects portable and desktop computer users against data loss caused by unexpected power drops and AC line transients. In case of a power interruption, Datasaver provides at least two minutes of power for an orderly shutdown and includes an overvoltage transient suppressor, visible and audible alarms, electronic interrupt signal, and 12-volt battery jacks.

The 90-watt Datasaver ($395) supplies enough power for portable microcomputers and most Apple systems. The 200-watt version ($695) provides protection for larger systems such as the IBM PC.

Write to Cuesta Systems, 3440 Roberto Court, San Luis Obispo, CA 93401. □

Circle 216 on inquiry card.

How many pieces of software can you use on the IBM Personal Computer?
1,000 and up.

IBM®

Circle 61 on inquiry card.

Construction Costs Profile
A - Materials (24%)
B - Labor (16%)
C - Overhead (33%)
D - Land (27%)
A
B
C
D
TEXAS INSTRUMENTS

Only the Texas Instruments Professional Computer offers these 7 advantages that add up to more computer for your money.

If you're a smart business professional, you want a business computer that gives you the most productivity power for your dollar. For you, Texas Instruments has the answer: the TI Professional Computer. With seven obvious advantages that make buying TI make sense.

The Disk Storage Advantage.

The TI Professional Computer gives you standard 320K floppy disk storage. That's twice the standard data storage of the leading competitor.

The Function Key Advantage.

We give you 12 function keys that you can easily preprogram to make your work simpler and easier. The best the competition can do is 10 or fewer function keys.

The Keyboard Advantage.

Our standard touch-typing layout makes word processing as easy as sitting at a typewriter. The separate numeric and cursor control keypads let you isolate information and enter numbers for spreadsheets more quickly. And with our isolated edit/delete keys, you'll never have to worry about accidentally erasing valuable data.

The Monitor Advantage.

Our monitor gives you 40-50% better resolution than the leading personal computers. Which means you get clearer displays that are easy on the eyes. And some of the sharpest graphics possible today.

The Software Advantage.

There's software available now for the TI Professional Computer that meets virtually every professional and small business need. And with our memory expansion board, you can use advanced integrated software like Lotus 1-2-3™ to help you do several kinds of work without changing programs.

The Expandability Advantage.

Our standard features like the floppy disk controller and printer support are built-in so they don't take up the valuable expansion slots you'll need for adding optional features like communications and up to ten megabytes of hard-disk storage. Which leads to one of our most exciting advantages...

The Future Enhancement Advantage.

No one wants to buy a personal computer that's already on the road to obsolescence. That's why we're developing exciting new features that you can easily add to your TI Professional Computer—like speech recognition. Imagine being able to say, "Spreadsheet, please" and having it appear instantly on your monitor. This and more will be available this fall.

One additional benefit makes the TI Professional Computer especially attractive — the price. Feature for feature, dollar for dollar, you'll get more computer for your money.

Get the business computer that puts these benefits to your advantage. Visit your TI authorized dealer or write: Texas Instruments Data Systems Group CA, Dept. 062PL, P. O. Box 402430, Dallas, TX 75240. Or call toll-free: 1-800-527-3500.

TEXAS INSTRUMENTS

Creating useful products and services for you.

Circle 155 on inquiry card.

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1-2-3 and Lotus are trademarks of Lotus Development Corporation

With all the clamor about personal computers, a fundamental fact is often overlooked: some simply *work* better than others.

Consider the COMPAQ Portable.

A computer will make you more productive. A computer will make you more efficient. You hear it everywhere. But you don't hear much about which computer actually *works* best.

The COMPAQ Portable fits under a standard airline seat for business trips.

Works in more places

With the COMPAQ™ Portable, you can be as productive in your hotel room or your lake house as in your own office. It's a reliable companion on a business trip. It's a powerful sales aid in your customer's office.

You can move it from office to office to share its resources. You can move it into the conference room to answer questions.

What's more productive than a computer? A computer that works for you in more places.

Works with the greatest number of programs

The most important consideration when choosing a computer is "what programs will it run?"

The COMPAQ Portable runs more programs than any other portable. In fact, it runs more than most non-portables because it runs all the popular programs written for the IBM® Personal Computer without any modification. There are hundreds of them. They are available at computer stores all over the country.

Imagine the power of a *portable* word processor. There are dozens of word processing programs available for the COMPAQ Portable.

Planning, problem-solving, and "what-ifs" are a cinch with a variety of popular electronic spreadsheet programs. The COMPAQ Portable runs them all.

There are accounting programs for anything from computerizing your family budget to full-scale professional management of payables, receivables, inventory, and payroll.

There are programs for making charts and programs for communicating with other computers.

So you get portability and you don't give up problem-solving power.

The combination adds up to the most useful personal computer on the market today.

Add-on options make it work the way you work

Inside the COMPAQ Portable are three open slots. Most portables don't have any. Electronic devices called expansion boards fit those slots and give the COMPAQ Portable new powers. As with programs, expansion boards designed for the IBM will work. With them, you can make your personal computer more personal.

Want to check a stock price? One expansion board enables the COMPAQ Portable to handle those communications over ordinary phone lines.

Want to use your company's central computer files while you're on a trip? There are boards that allow the COMPAQ Portable to communicate with a variety of large computers.

Other boards let you hook up controllers for computer games, increase memory capacity, or connect several personal computers in a network.

The added usefulness is free

The COMPAQ Portable doesn't cost any more than an ordinary desktop computer. In fact, it costs hundreds less than a comparably equipped IBM or Apple® III. The COMPAQ Portable comes standard with one disk drive and 128K bytes of memory, both of which are usually extra-cost options.

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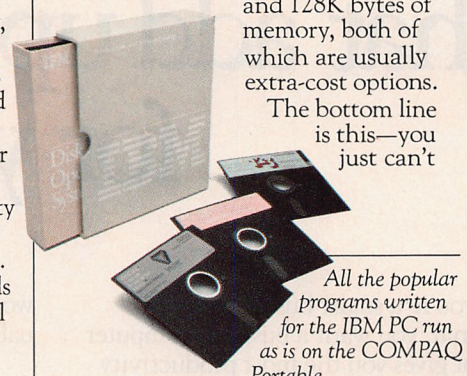

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Business

Busisoft Analyzer—A financial statement analysis program that produces a variety of ratios based on information you input from company balance sheets and income statements. You can enter data for up to five financial periods in order to spot trends and problems. For the **IBM Personal Computer**; $199.50. Busisoft Corp., 6140 Horseshoe Bar Rd., Loomis, CA 95650.

DBPACK-II—A relational database management system, featuring error checking, user-specified text length, global changes, online help, and data entry into several relations simultaneously. For **CP/M-based** systems with a minimum of 48K bytes of memory; $395. Compu-Draw Software House, 1227 Goler House, Rochester, NY 14620.

Data Storage and Display System—A program that offers graphing and data-storage capabilities. The package can hold up to 25 files that allow you to store and monitor data on the stock market, experimental data, or any numerical data. Files can be recalled as either a tabular list or as a graph. For the **Timex/Sinclair 1000**; $14.75. ZX-Panding Ltd., POB 25, Newton, NC 28658.

The Executive Package—A collection of over 50 BASIC and Visicalc spreadsheet programs and tables designed to provide a complete package for businesses. Derived from the book *Executive Computing* by John Nevison, the package works in conjunction with **Visicalc, 1-2-3,** or **Multiplan** and allows users to develop their own approaches for solving problems. For the **IBM Personal Computer**; $145. Alpha Software Corp., 12 New England Executive Park, Burlington, MA 01803.

Farm Weather Center—An easy-to-use agricultural application that utilizes data on temperature, precipitation, and three optional weather variables to produce estimates of crop development, soil moisture, and crop stress. A core disk works on the main programs and separate disks are available for corn, soybeans, spring wheat, and winter wheat. Core disk with local climate database, $295; individual crop disks, $125 for the non-irrigation version, $245 for the irrigation scheduling version. For the **IBM Personal Computer** with 128K bytes of memory and graphics card. Climate Assessment Technology Inc., Suite 355, 11550 Fuqua, Houston, TX 77034.

Forms Foundry—A program for small businesses that lets you generate professional-looking business forms. This menu-driven package handles invoices, purchase orders, statements, debit and credit memos, and more. For the **Apple II** and **III**; $149.95. Phoenix Software Inc., 64 Lake Zurich Dr., Lake Zurich, IL 60047.

Knowledgeman—A relational database manager that includes an ad hoc inquiry mode, statistical analysis, spreadsheet analysis, printed forms management, and customized modeling with a built-in structured programming language. For **PC-DOS, MS-DOS,** and **CP/M-86-based** systems; $500. Micro Data Base Systems Inc., POB 248, Lafayette, IN 47902.

Life Goals—A financial-planning program for stockbrokers, investment advisors, and life insurance agents. Using information about current financial situations, **Life Goals** provides a customized financial plan to help clients meet their goals. For **CP/M-** and **MS-DOS-based** systems with 64K bytes of memory; also requires Supercalc and Wordstar with Mailmerge; $945. Kinnaird Softplans, 2953 N.E. Brogden St., Hillsboro, OR 97123.

Master Tax—A tax preparation package for accountants, tax practitioners, and financial advisors. Provided with the program are an illustrated workbook and audiotape instructional cassette that act as backups for the user manual. Master Tax printouts meet all IRS requirements. For **CP/M-80, CP/M-86,** and **MS-DOS-based** systems; $1695. Annual updates are available for $565. CPAids, 1061 Fraternity Circle Dr., Kent, OH 44240.

Multi-trieve—A database management system that features the ability to display multiple records on the screen in the form of a table; also included are left and right justification, column headings, decimal point alignment, and running totals for numeric fields. For the **Apple II** and **IIe**; 80-column card recommended; $199. Multisoft, 120 East 90th St., New York, NY 10028.

The Nibble Investor—A stock-tracking program that reports stock price performance and transaction volume using high-resolution graphics. This program can track high-low stock closings, 13- and 52-week moving averages, and price/market-strength indications. For the **Apple II** and **IIe**, $29.95. Nibble, Dept. P, POB 325, Lincoln, MA 01773.

Games

Android—You control an android that has been sent to a distant planet to gather treasures from a labyrinth beneath the planet's surface. Armed robots guard the labyrinth, which has five levels. In order to win the game, your android must get past the robots and through all five levels to return home with the treasures. For the **Atari 400** and **800** with 40K bytes of memory; $29.95. Program Design, 95 E. Putnam Ave., Greenwich, CT 06830.

Baseball Adversary—A strategy game that pits you against the computer. Given a situation, you must decide what action to take to defeat the other baseball team. Features include pinch hitters and relief pitchers. For the Commodore **VIC-20**; cassette, $10.95. Parr Programming, 2664 Tyler St., Gary, IN 46407.

Clipper: Around the Horn in 1850—As captain of a clip-

New Software provides up-to-date listings of the latest releases in microcomputer software, grouped into seven categories: Business, Games, Home, Education, Programming Languages, Word Processing, and Technical Tools. New Software listings are based on product information supplied by the manufacturers and should not be considered endorsements of the products listed. For in-depth evaluations of the most important and interesting new releases, read our Software Review section.

per ship you try to maneuver your way from New York to San Francisco via Cape Horn in the fastest time possible. You must also decide how much cargo and provisions to carry and how many crew members you'll need. Along the way your voyage will be threatened by storms, calms, and mutinies. For the **Atari 400** and **800**; package includes both cassette (requires 24K bytes of memory) and disk, $29.95. Program Design Inc. (see address above).

Football Adversary—In the role of coach, you call the plays and try to score a touchdown before your opponent (the computer) does. Besides the computer you also have the clock working against you. Included in the package is a coach's play card, display of statistics, and static game clock. For the Commodore **VIC-20** with 13K bytes of memory; cassette, $14.95. Parr Programming (see address above).

Klendathu—A space adventure game for one or two players based on the book *Starship Troopers*, by Robert A. Heinlein. You are on a Terran Federation starship where you serve as a mobile infantry fighting the bug wars on the planet Klendathu. Each player is given three chances to destroy as many bugs as possible before returning to the ship. A successful mission will earn you a promotion and higher pay. For the Radio Shack **TRS-80 Color Computer**; cassette, $14.95. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

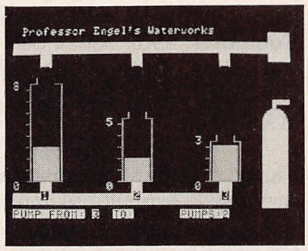
Police Artist—A collection of three different games that allow you to draw more than one million faces. The three games ask you to remember a culprit's face and recreate it, pick a face from a lineup, or simply draw faces choosing different characteristics. For the **Apple II** and **IIe**; $34.95. Sir-Tech Software Inc., 6 Main St., Ogdensburg, NY 13669.

Vault of the Centaurs—An adventure game that sends you on a mission to conquer the centaurs. Hidden within a secret vault is a valuable fossil fuel called Zykon which is an energy source vital to the existence of your planet. If you can overcome the centaurs and other obstacles, you can save your planet and win the game. For the **Timex/Sinclair 1000**; cassette, $19.95. Orbyte Software, POB 948, Waterbury, CT 06720.

The Wizard and the Princess—A graphic adventure game in which each player must find the evil wizard's castle, storm it, defeat the dragon guarding the gate, and find and rescue the princess. As a final challenge, once you have found the princess, you must slay the troll that guards the bridge in order to escape from the castle. For the Commodore **VIC-20**; $14.95. Melbourne House Software, 333 East 46 St., New York, NY 10017.

Education

Best Computer Coach—Combining computer graphics with an audio track, this program helps you learn the various elements that make up a computer system. For the **Commodore 64**; $19.95. Also available for the **Atari 400** and **800, VIC-20, TI 99/4A,** and **Apple IIe**. Boston Electronic Systems Training, 24 Munroe St., Newtonville, MA 02160.



Comp-u-solve—A series of puzzles that motivate students to develop problem-solving skills. Two levels of difficulty are available for the 10 individual puzzles presented. The easier level provides help options and partial solutions to avoid player frustration. For the **Apple II** and **IIe**, and the **TRS-80 Model III**; cassette, $89; disks $49 each or $89 for two. Educational Activities Inc., 1937 Grand Ave., Baldwin, NY 11510.

Crypto-Cube—A word puzzle program for one or two players. Crypto-Cube is a rotating cube that features a crossword grid on each side. Players can choose from 50 different puzzles or make up their own word list, which the computer's puzzle generator will place on the cube. For the **Apple II** and **IIe, IBM Personal Computer, Atari 400, 800** and **1200XL** with 48K bytes of memory; $39.95. Designware Inc., 185 Berry St., San Francisco, CA 94107.

French Achievement I and Spanish Achievement I—Two separate programs designed to increase your vocabulary and prepare you for the College Entrance Examination Board's French and Spanish Achievement Exams. The answers are presented in multiple-choice format and correct answers are given with a full translation when a question is missed. For the **Apple II** and **IIe**; $39.95. Microcomputer Workshops Corp., 225 Westchester Ave., Port Chester, NY 10573.

Math Blaster!—An arcade-type educational game in which the student is presented with a mathematical problem and several different answers. In order to score points the player must blast the correct answer by shooting a man out of a cannon. For the **Apple II** and **IIe**, and **IBM Personal Computer**; $49.95. Davidson & Associates, 6069 Groveoak Place #12, Rancho Palos Verdes, CA 90274.

Micro Math—A series of math programs for students ages 12 to 16. Problems are presented one at a time; if the student answers correctly, he or she moves on to the next question. If a student answers incorrectly, the computer provides a clue to the solution; if the answer is incorrect the second time, the right answer is displayed. For the **Timex/Sinclair 1000** and **ZX81**, Commodore **PET**, and **VIC-20**; $50. PM International, POB 87, Buckfield, ME 04220.

Quotrix—An educational game in which the players try to guess a famous quote using clues in the form of crossword puzzles, trivia questions, and foreign word translations to piece together the words of the quote. For the **IBM Personal Computer** with 64K bytes of memory; $34.95. Insoft Inc., Suite 202B, 10175 S.W. Barbur Blvd., Portland, OR 97219.

Spellicopter—In the role of a helicopter pilot, you must "rescue" letters from a distant field then organize them to form a word. Along the way obstacles will provide the challenge of getting the chopper back before you run out of fuel. For the **Apple II** and **IIe, Atari 400, 800** and **1200 XL**, and the **IBM Personal Computer** with 48K

bytes of memory; $39.95. Designware Inc. (see address above).

Tutorial Comprehension—A tutorial program designed to strengthen five reading comprehension skills: main idea, details, sequence, inference, and critical reading. The program presents 20 different routines divided among the 180 practice lessons and is geared toward students at the second, third, and fourth grade reading levels. For the **TRS-80 Model III**, all five sets, cassette, $840; disk, $995; **Apple II**, $995. Random House, Suite 103, 7307 South Yale Ave., Tulsa, OK 74136.

Word Attack—A vocabulary-building program that includes over 675 words and allows you to enter additional word lists. Nine skill levels allow students to work at their own pace. For the **Apple II** and **IIe** and the **IBM Personal Computer**; $49.95. Davidson & Associates (see address above).

Wordtrix—A word game that pits you against the computer or another person. The object is to score points by locating as many words as possible on a grid made up of random letters. Extra points are scored for long words. For the **IBM Personal Computer** with 64K bytes of memory; $34.95. Insoft Inc. (see address above).

Home

Bat-stat—A program that tracks and maintains a record of cumulative batting statistics for each member of a baseball team. The menu-driven program can keep track of up to 20 players in 10 categories: at bats, runs, hits, batting average, doubles, triples, home runs, sacrifices, walks, and runs batted in. For the **Apple II** and **IIe**; $49.95. Rainbow Computing Inc., 19517 Business Center Dr., Northridge, CA 91324.

Diet—A computer-aided diet program that provides "no calorie" menus, weight charts for 12 weeks, information on your ideal weight, and the number of calories you can consume to maintain your ideal weight, and more. For the **Apple II**; $15.95. Hallie Software, POB 4383, Auburn Heights, MI 48057.

ES Painter—An uncomplicated program that lets you use a color monitor as a drawing board. With a joystick you guide your pen to draw any type of picture you want. Two keystrokes allow you to fill in any area of the picture with the color you choose. Geared for both children and adults. For the **IBM Personal Computer** with 64K bytes of memory, color graphics adapter, and joystick; $45. E & S Software Services, POB 238, Bedford, MA 01730.

The Family Connection—A genealogical program with a capacity for over 7000 records, alphabetical sorting, allowance of up to three spouses per person, automatic updating of parents' records when a child is entered, user-defined data formats, charts, and reports. For the **Apple II** and **IIe**; $99.50. Discovery Software, POB 68821, Indianapolis, IN 46268.

Nutritionist—An interactive graphics diet-analysis program that displays the nutritive analyses of foods in weight and percent of the government's recommended daily allowances for 19 nutrients. The database comes with analyses of 730 foods and is expandable. For the **Apple II**, the **IBM Personal Computer** with 64K bytes of memory, and **CP/M-based** systems; $145. N-Squared Computing, 5318 Forest Ridge Rd., Silverton, OR 97381.

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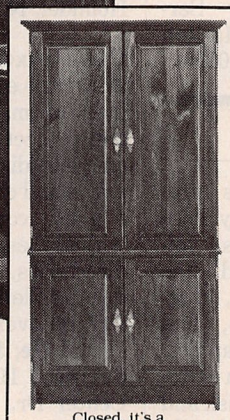

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Portmap—An analysis program for investment portfolios, including stocks, bonds, money-market funds, and other securities. Portmap produces a summary report on cost basis, number of units, and expected income. A special report is provided with the information you'll need at tax time for filing Schedule D. For the **IBM Personal Computer** and **CP/M-** and **MS-DOS-based** systems; $79.95. Single Source Solution, 2699 Clayton Rd., Concord, CA 94519.

Visible Piano—A program that converts your IBM Personal Computer into a playable musical instrument. Included is a plastic keytop which you place over your keyboard to make it look and feel like a standard piano keyboard. When using the program you'll be able to hear and see the notes as they are played. No additional hardware is required. For the **IBM Personal Computer**; $45. Synthalytics, POB 45131, Westlake, OH 44145.

Word Processing

Megawriter—A word-processing program that features mail-merging and a full 80-column page without the need for an 80-column board. Megawriter is menu-driven and has the ability to move and copy large amounts of text at one time. Documents can be printed with underlining, boldface, and more. For the **Apple II** and **IIe**; $59.95. Megahaus, Suite 1200, 8950 Villa LaJolla Dr., LaJolla, CA 92037.

Samna Word—An easy-to-use program that provides on-screen help functions when needed. The program can display multiple windows at the same time, lets you edit two documents simultaneously, and allows you to move text from one document to the other. At all times the screen displays a close representation of what the finished document will look like when printed. For the **IBM Personal Computer, DEC Rainbow,** and **Texas Instruments Professional Computer**; $450. Samna Corp., Suite C-1200, 2700 N.E. Expressway, Atlanta, GA 30345.

Script 64—A full-function word-processing system with a built-in dictionary that can be expanded to 20,000 words. Script 64 can store deleted text in a buffer, then recall it and place it anywhere. Other features include automatic page numbering, headers and trailers, redefinable keyboard functions, output to video with horizontal scrolling, and help screens. For the **Commodore 64**; $139.95. Computer Marketing Services Inc., 300 West Marlton Pike, Cherry Hill, NJ 08002.

Languages

Graforth—A graphics programming language by Paul Lutus, Graforth lets you develop plotting and line graphics, text display, character-image graphics, and three-dimensional graphics. Programs written in Graforth can be saved to disk and run without additional software. For the **Apple II** with 48K bytes of memory; $75. Insoft, Suite 202B, 10175 S.W. Barbur Blvd., Portland, OR 97219.

Technical Tools

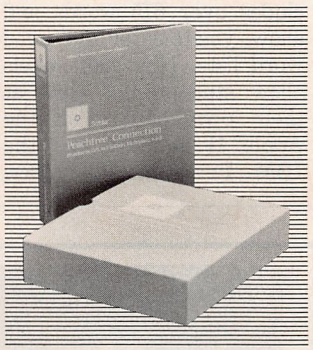
ALE—A disk-based assembly-language editor and assembler that can edit three different editor/assembler formats as well as its own file format. The package includes a special utility to convert your old files to the ALE format. For the **TRS-80 Models I** and **III** with 48K bytes of memory and one disk drive; $49.95. The Alternate Source, 704 North Pennsylvania Ave., Lansing, MI 48906.

Big Print—A utility program that allows you to print messages in letters up to 7 inches high. The program is menu-driven and will work with any standard printer. For the **IBM Personal Computer**; $50. ATC Software, R2 Box 448, Estill Springs, TN 37330.

Compac—This program reduces the size of ASCII or binary files by 10 to 40 percent. Compac is not limited by type of file or file size. Included in the documentation are examples for each command and an extensive error message guide. For the **IBM Personal Computer**; $35. Sextant Systems, POB 251, Holmdel, NJ 07733.

Disk Fixer—A tool that allows the experienced Apple user to manipulate, repair, and protect any data stored on your disks. You can examine and change any section of a disk, correct space usage within files, alphabetize the directories, or resurrect a deleted file if it has not been written over. For the **Apple II** and **IIe**; $49.95. RCI Marketing, 19517 Business Center Dr., Northridge, CA 91324.

Fastload—A program that lets you save and load data up to six times faster than usual. The package comes with two programs: Keyboard Monitor, a BASIC program that tells you the speed at which the tape was recorded, file name, file type, number of bytes in file, and whether a read error occurred; and Fast Loader, which speeds up the loading process and eliminates the need to reload the monitor each time. For the **Timex/Sinclair 1000** and **ZX81**; $19.95. International Publishing & Software Inc., 3952 Chesswood Dr., Downsview, Ontario, Canada M3J 2W6.



Peachtree Connection—Lets you connect the Peachtree General Ledger directly to a spreadsheet program. Up to five years' worth of accounting data can be organized and set up on preformatted templates for **Visicalc, Multiplan,** and **1-2-3**. For the **IBM Personal Computer**; $95. Sofstar Inc., 13935 U.S. #1, Juno Square, Juno Beach, FL 33408.

Ultra Disassembler—A programming tool that recreates the source code from which a machine-language program was assembled. The program disassembles DOS files and code from a specified list of disk sectors and produces fully labelled code. For the **Atari 400, 800** and **1200XL** with one disk drive; $49.95. Adventure International, 507 East St., Box 3435, Longwood, FL 32750. □

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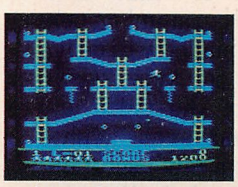

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Your job? Use your lightning speed to scale ladders, scurry across girders, climb ropes and race through 30 levels to defuse the bombs before they go off.

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Software's New Crossroads

Integrated packages vs. "problem solvers"—simpler software is the goal

by A. Richard Immel

I am convinced that the two fastest-growing industries in America today are high-tech market research and computer shows. I don't know which inspires less confidence, the market forecasters with their endless predictions of five computers in every home by the seventh day of the seventh month or those strange folks who man (and woman) the booths at computer shows and treat you like a pariah if you have the audacity to ask a substantive question about their wares. You know the type—those perfectly coiffed young men and women with their airline smiles, their glittery eyes, and the unsettling aura that leaves you with the impression that they've spent their entire adult lives on another planet. "Software? Sure, pal, it runs lots of software. Lots."

Thank God there's always the sideshow. I mean those seminars and panel discussions in the expo's hard-to-find meeting rooms that bring together all sorts of experts to talk about topics of burning interest like "Bit-twiddling in the 1990s" and "Whither the 64K chip?" Sometimes these are no bargain either, but every once in a while a good seminar pops up. That was the case earlier this year in San Francisco at a show called CP/M '83. The show itself was no great shakes, but the symposium called "The Future of Microcomputer Software" drew a herd of humanity that could have stood in for the funeral throng in *Gandhi*.

The main reason for the big draw was the caliber of the panelists—the best from Apple, Atari, Osborne, Visicorp, and Software Arts—all of whom waxed eloquent about software trends. This meeting of the minds was spiced with humor (Adam Osborne's masterful gibes), mistaken identity (Visicalc coauthor Dan Bricklin was mistaken for his partner, Bob Frankston), and, most fun of all, a running battle between Osborne and Alan Kay, the inventive chief scientist at Atari.

Illustration by Keith Bendis

Aloha to Programming?

What makes this event relevant to our concerns in this column is that the discussion touched on one of the most significant trends in business computing today: practical alternatives to programming languages.

No businessperson in his or her right mind should buy a computer and expect to program it. That's not to say it can't be done or that I'm against programming per se or learning how to do it. It's great for kids (keeps 'em out of the video arcades), and even adults might get a few useful insights into their thought processes with some forays into the BASIC jungle of nested loops, subroutines, and GOTOs.

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Who Uses CompuPro?

In a giant testing facility in Mississippi, the engines of America's grandest scientific enterprise are constantly being perfected. To help NASA's engineers, four **CompuPro** systems are used to access the results of testing the space shuttle's powerful motors.

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It's just that a language like BASIC, which is the most accessible to beginners, is generally inappropriate for serious business software because it's too slow for large programs. Moreover, it's the rare bird who can spare the time to create the software that a business must depend on day in and day out. (I'm sure I'll get letters from rare birds who've made millions with nifty BASIC programs they whipped up while waiting for the bus. I *won't* get letters from the ones who lost a bundle or whose businesses folded because they frittered away too much time programming their computers.)

Business users must depend on applications written by programmers of varying abilities who assume they know what your problems are and then proceed to lash together something that more or less deals with the situation. Wouldn't it be nice if we could all bypass that godlike programmer who invariably leaves out something we really need or includes something peculiar to foul up an otherwise flawless package? Wouldn't it be nice if we had some kind of easy-to-use framework or tool, as it were—something along the lines of a Visicalc, perhaps, but with broader applications? That way we could create our own applications packages without actually having to delve into the black art of programming.

Two Paths, Same Goal

Unfortunately, computer science isn't sufficiently advanced to provide tools like this—yet. A lot of people are thinking about it, though, and some interesting advances are being made along two separate but related lines of development: the integrated software package and what is variously called "specification" or "problem-solving" software.

The goal in both cases is the same: to give the user a way to customize applications packages to solve particular and sometimes even unique problems. The approaches are quite different, however. The integrated package lumps together a bunch of useful applications (generally a spreadsheet, a word processor, a database, and some kind of graphics program). The actual framework for this (or "metaphor," to use the jargon in vogue) often takes the form of an all-encompassing *window* system that places each application in its own window on the screen.

Specification programming is a bit different. This approach involves "telling" the computer what kind of solution you want. Visicalc is probably the best example of this type of programming; you use very flexible tools to lay out a method of solving your problem, after which you enter only the numbers to be acted on by the computer. TK Solver, a new Visicalc-like program that does the same thing with formulas instead of numbers, is another example.

Integrated-Software Categories

Not all the integrated packages on the market are sophisticated window systems. The simplest approach uses a collection of applications programs that may be chosen from a menu or other indexing scheme, often at the operating system level. Concurrent CP/M and Catalyst (for the Apple III) are examples of integrated software packages that let you store several programs somewhere in the computer or on disk (hard disk in the case of Catalyst) and then switch back and forth among these programs without having to start from scratch every time. Data is not exchanged between applications in this sort of system.

Software packages such as Lotus's 1-2-3 and Context's MBA combine elements of both the integrated and problem-solving approaches. While both are technically integrated offerings (in that they give the user a word processor, spreadsheet, database manager, and graphics program concurrently), the spreadsheet in both instances is modeled after Visicalc, the father of specification programming. Both 1-2-3 and MBA are capable of moving data back and forth between programs (or simply having different programs use the same data simultaneously).

The most elaborate and flexible type of integrated software is the mouse-activated window system. Examples are Apple's Lisa and the Xerox Star. Coming soon are similar packages from Visicorp (Visi On), Microsoft, Quarterdeck, and others.

In these systems, the windows are rectangles on the screen created at the touch of the handheld mouse controller that opens and closes them, changes their size, moves them around the screen, and deletes them. You can think of these windows as empty boxes into which you can put various things like text, graphs, drawings, or entire applications programs such as spreadsheets.

Adequacy versus Innovation

Once you've got a handle on what integrated software and problem-solving programs are, the question then becomes whether these developments will be of much importance in the next couple of years. Adam Osborne's answer from the CP/M '83 podium at Moscone Hall was a resounding no, but Alan Kay's response was, "Well, why not?"

Surprisingly, it was Kay who extolled the virtues and power of the problem-solving approach, claiming it is preferable to the window systems used in Apple's Lisa and Visicorp's Visi On. These comments were unexpected because it was Kay's research at Xerox's Palo Alto Research Center that provided the basis for all these "new" window systems.

"I think Visicalc's notion of little cells that talk to each other—and especially cells that can be chained together to perform tasks—is a more powerful idea than the win-

A. Richard Immel is a contributing editor of *Popular Computing*.

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dow concepts we developed in the '70s," Kay said.

Atari's research chieftain would like to see such an approach go far beyond spreadsheets, however: "If you think of Visicalc as a kind of kit for doing things, then we have to ask the question, 'Are programming languages relevant anymore?' I don't think that they are."

In their place Kay proposes what he calls a "kit-kit" that could be used to "make things like Visicalcs and a whole bunch of other applications as well. I think that's a much more powerful way of dealing with the computer resource than through the programming-language metaphor."

That may sound perceptive to you and me, but to Adam Osborne it's just so much highfalutin hogwash. Osborne, who has had the character-building experience of doing daily battle in the marketplace, is a dyed-in-the-wool pragmatist whose views are diametrically opposed to Kay's on just about every hardware or software issue. Osborne kicked off his remarks with a confession. "Alan is one of the nicest guys I know," he blurted. "He's also the person I've disagreed with more than anyone else in the industry."

Osborne went on to sound his favorite maxim: adequacy is sufficient; all else is irrelevant. "Rather than trying to determine what is the most beautiful software or which is the most aesthetically pleasing, I look instead at the Darwinian process of natural selection, which seems a metaphor for what's occurring in our industry. The average computer user is about as interested in the Ultimate Software concept as the average car driver is in the latest carburetion techniques for racing cars. They don't want that—they want dependable transportation. They just want a car that keeps going, and it doesn't have to offer any great performance beyond that. Similarly, the average computer owner wants programs that do the desired job conveniently and consistently. Adding too many features, in fact, detracts from the ability to sell the product."

As for integrated-software systems, Osborne contends that they're coming "not for any of the philosophical reasons that people may give you about the beauty of their architecture, but simply because people don't like having to use an extra command to get from a word processor to a spreadsheet. People are going to look for convenience. They are not necessarily looking for greater performance."

Kay quietly bode his time until the question period and then pounced on what he saw as Osborne's Achilles' heel: the adequacy issue.

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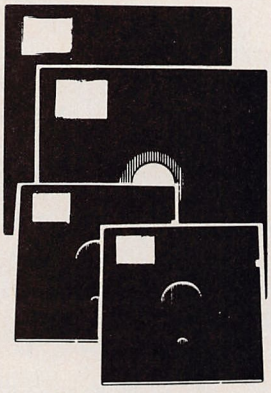

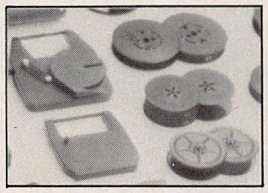

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"I feel that Adam is trying to make computerdom safe for the Dukes of Hazzard," cracked Kay, eliciting a big laugh from the audience. "TV is a perfect example of an industry making its way in the world by convincing people that shows like *Laverne and Shirley* are adequate entertainment. I agree with that philosophy and it works, but the nice thing about television—and I think this is even more true of the computer field—is that there's room for shows like *M*A*S*H* and *Masterpiece Theater*, too. I believe that quality products tend to improve the rest of the breed by osmosis. There are lots of different ways of making money, and I think one of them is by doing good things." (Hearty applause.)

Osborne: "The networks did not persuade the population that *Laverne and Shirley* was adequate. The *population* persuaded the networks that *Laverne and Shirley* was adequate." (More applause.)

Kay: "Adequacy is what you can get by with. I've not used a single word processor on any microcomputer that I think is adequate. It's not because they lack the features; it's because most of the designers have no idea how to cut down the features and still retain the function."

Yes, CP/M '83 certainly wasn't short on badinage. Curiously, Kay's idea that the spreadsheet approach is more powerful than the window and mouse was not well received by Dan Fylstra of Visicorp, one of the people who has most benefited from the great success of spreadsheets. Perhaps thinking of the pots of money Visicorp has already sunk into the development of the Visi On window-and-mouse system—rumored to be $7 million—Fylstra pointed out that mouse technology has been around for about 10 years but is only now starting to get out to the public at large. "If you're Alan Kay you're ready to move on to something better, but these people [researchers like Kay] number only in the few thousands," he noted.

Fylstra said Visicorp has found in its research that the average person tends to get hooked on mice. He believes that as more and more people are exposed to this exciting technology they'll become, in his words, "converts and not want to go back. And then I think you'll see a real snowballing effect. Mice will drop in price and become just a common peripheral that ultimately will appear on most kinds of computers."

For those of us who don't have millions of dollars riding on this crucial decision of integrated packages versus "kit-kits," it really doesn't matter which philosophy finally triumphs. The important thing is that the computer industry is exhibiting a consistent desire to make software simpler and more flexible from the user's point of view. And that means that there will come a time when mere adequacy *isn't* enough.

But it's far too early to sound the death knell for programming languages. Over the short term, the number of programmers plying their craft is sure to grow. Here's all the evidence you need: at one point during CP/M '83, one of the speakers asked how many programmers were in the packed-to-capacity audience of some 1500 souls. About 1000 arms shot into the air. God help us all. □

Buyer's Guide to Integrated Software

Integrated software packages certainly don't come cheaply: Context's MBA sells for $695 (IBM PC) and $795 (Hewlett-Packard Series 200); Lotus's 1-2-3, now configured for the IBM PC, lists for $495. Versions for the Victor 9000 and the TI Professional Computer should be released soon.

The main thing to remember is that you're not evaluating a lone program; you've got to weigh the merits of four or five at the same time. Here are some questions to ask yourself when you start seriously comparing the various integrated packages:

- Do you really need or want all of the applications in the package? If not, you're paying a lot of money for extra baggage.
- Do you like the way each of the integrated programs works? Many businesspeople find they like some programs but not all. If people are accustomed to an existing spreadsheet or database package, chances are they'll resist learning a new one. Another consideration is whether the system duplicates software you already have.
- Can applications be changed or added ("open" system), or is it like the no-substitutions blue plate special at Bluto's Cafe ("closed" system)? MBA and 1-2-3 are closed systems; the companies that designed them have decided on what you need and how it should work (although they say they plan frequent updates and improvements). Visi On and Quarterdeck's DesQ are considered open systems in that applications packages from other vendors can be "dropped into" the windows. Apple's Lisa is also open in a similar way, but just how quickly other software companies come up with programs for these systems remains to be seen.
- How well (or quickly) does it run on your equipment? Or, looking at it from the other direction, what kind of hardware is required to make it run adequately? All the systems I've mentioned here basically require a full complement of random-access memory (at least 256K bytes). In addition, a hard disk is a virtual necessity to do useful work.
- Do you need a sailboat or a yacht? A friend of mine has coined the phrase "the Sailboat Syndrome" to refer to a common scenario. You start out with a little boat and have a lot of fun learning to sail. After you're thoroughly hooked, you keep trading up to bigger and better boats until you wind up with a yacht that takes three people to operate. In short, what once was fun is now more trouble than it's worth. When buying software, never let the product's astounding capabilities stifle your sense of fun.

After you ask what it can do for you now, ask what it can do for you later.

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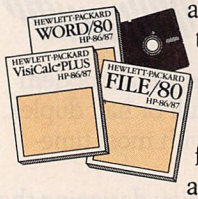

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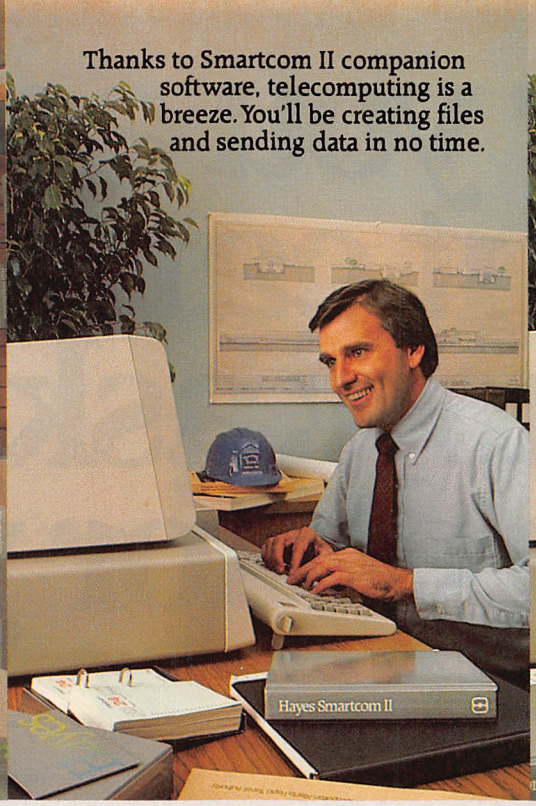

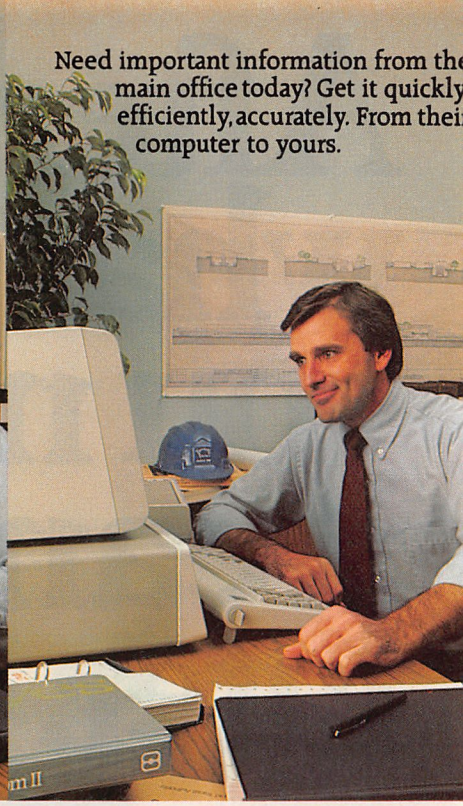

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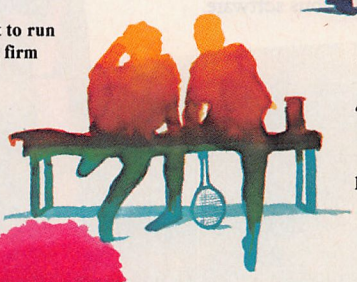

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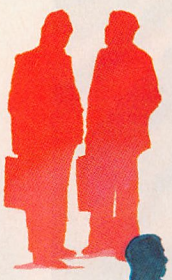

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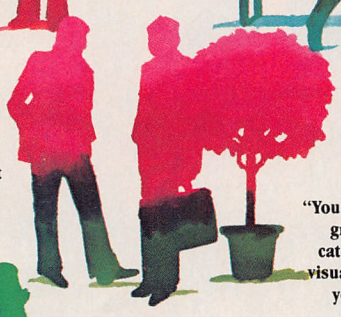

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* Popular Computing, November, 1982
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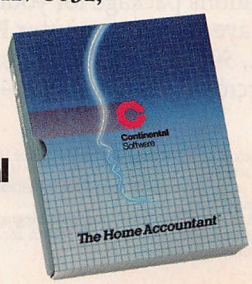

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How to Run Benchmarks

These simple tests let you gauge the speed of your system

by William Barden Jr.

The IBM PC, the Apple IIe, the Radio Shack Model 4, the DEC Rainbow, the Commodore 64—the list of microcomputers goes on and on. Which is best? How do you measure one computer system against another? One way to do it is by running benchmarks.

In surveying, a bench mark is a mark against which all measurements are made. The computer industry long ago adopted this surveying term to use in its own jargon (squeezing it into one word in the process). In computerese, a benchmark is a test that measures the speed, accuracy, or other operational parameters of computer equipment.

In this column we'll look at benchmarks for BASIC, disk operations, and line printers, discuss tests for other equipment, and describe how you can run your own benchmarks.

A Simple Benchmark

One extremely simple benchmark for BASIC operations is the following program:

```
100 FOR I=1 TO 30000
110 NEXT I
120 PRINT "DONE"
```

What does this program do? It simply repeats a loop (lines 100 and 110). If you could trace the program, you'd see line 100 executed, followed by line 110, then line 100 again, then line 110, and so on 30,000 times. Each time through the loop (an *iteration*), the variable I is increased in value by 1, so I grows by 1s from 1 to 30,000. At the end of the loop, line 120 is executed and the message DONE is printed on the screen.

Illustration by John O'Leary

This program will work on just about any computer system. It should be entered into an empty system directly after the computer is powered up—this three-line program should be the only one in the computer's memory. Additional program lines that are unrelated to the benchmark could affect the speed of the program because of the way that BASIC interprets line numbers and finds variables.

To use this benchmark, simply enter the program and then type RUN. Just before you hit the ENTER or RETURN key, get ready to mark the time (you'll need a stopwatch for best results). Start the program and the stopwatch at the same time, and when the message DONE is printed, stop your stopwatch immediately. If you're in a computer store, try this on several different systems. You should see elapsed times ranging from 30 to 150 seconds.

Simple enough, but what does this test really measure? Is it fair? How accurate is it?

As you might suspect, this benchmark measures the speed with which a computer system executes simple BASIC

commands. It's a good first test to determine how efficient the system's BASIC interpreter is.

The speed of *interpretation* (decoding of BASIC commands by the BASIC interpreter) is most directly influenced by two factors. One is the "clock" speed of the computer's microprocessor, which determines how fast the internal operations take place. The second is the efficiency of the BASIC interpreter program—how tight its code is. Other factors such as the microprocessor's data size (8 or 16 bits) and memory speed do have an effect, but the computer's clock speed and interpreter program are the most important.

If this easily executed benchmark shows that system A is twice as fast as system B, then it's almost certain that more complicated programs will also run at least twice as quickly on system A as on system B.

Just for fun, I ran the test on some of my own computers. Here's what I came up with:

IBM PC: 38 seconds
Radio Shack MC-10: 40 seconds
Commodore VIC-20: 42 seconds
Radio Shack Color Computer: 68 seconds
Radio Shack TRS-80 Model III: 80 seconds
Timex TS1000: 131 seconds

Some surprises here, eh? One wouldn't expect inexpensive computers like the VIC-20 and MC-10 to make such a good showing.

The accuracy of this test does depend to some extent on how good you are with the stopwatch, but even a one-second timing error will give you results accurate to within a few percentage points. For almost all intents and purposes, it's a foolproof test for comparing one machine's BASIC to another's. You can also use this test for *compiled* BASIC, which will be on the order of three to ten times faster than interpreted BASIC. But testing a BASIC compiler involves learning how to edit, compile, and execute a program from the compiler, a project that may take several hours for a neophyte and is a far cry from walking up to a machine and keying in three lines.

Columnist William Barden Jr. writes about small computers from his home in Mission Viejo, California. His *Popular Computing* columns have been collected in *What Do You Do After You Plug It In?* (Indianapolis: Howard Sams and Co., 1983).

Benchmarks for Disk Files

Another important aspect of small computers that can be tested with benchmarks is disk storage in BASIC. If you have a disk system, you'll be using disk files constantly. BASIC generally uses one of two types of disk files, sequential or random. Sequential files are the simplest of the two and are often used for accessing data with ordered records. You might have a BASIC data file that holds a mailing list, for example. In that file are hundreds of records, one for each name, address, and telephone number in the mailing list.

How do you test BASIC's efficiency in using disk files? One way would be to work with several different systems using the same database—the same mailing list, for example. But a more practical benchmark merely simulates records. The program would use the same BASIC file commands as an applications program, but it would go rapidly through the test using dummy data. This is such a program:

```
100 REM BENCHMARK FOR SEQUENTIAL
    FILES
110 CLEAR 10000
      (not required on some
      systems)
120 CLS
130 A$=STRING$(33,"*")
140 OPEN "O",1,"SCRTCH:1"
      (file name format may
      differ)
150 PRINT"START"
160 FOR J=1 TO 1000
170 PRINT #1,A$: PRINT J
180 NEXT J
190 PRINT "END"
200 CLOSE 1
```

This program is designed for a system with two disk drives. It will run on many Microsoft BASIC systems with only minor modifications. To use the program, start off with a relatively clean disk—one with a lot of unused space. The ideal case would have a data disk without any files on it in disk drive 1. Key in the program and then execute it by typing RUN. You'll see a START when the program starts and an END when it ends. The interval between these messages is what you time.

The program writes out 1000 records to a disk file. Each record contains 33 asterisks. Why 33? Certain record lengths might be convenient for a particular system, especially if the lengths are factors of 256 (64, 128, and so forth). A length of 33 is more random, and no multiple of 33 (66, 99, 132, etc.) is evenly divisible by 256.

This benchmark reveals how efficiently the disk BASIC interpreter writes out those 1000 records (33,000 characters). The amount of unused space on the disk, the locations of any previous files, the type of disk used in the system, and the efficiency of the BASIC interpreter are among the factors that will affect a given system's performance. This is not the definitive test for BASIC disk file use, but it will give you a rough idea of whether one system is twice as fast as another. Running the benchmark on the IBM PC (double-density 5¼-inch drives) gave an elapsed time of 54 seconds.

The benchmarks presented so far will at least allow you to compare computer systems without the benefit of a salesperson's bias and hype. But here's an important point: the overall speed of a computer system's execution of BASIC is an important factor, but it is certainly not the sole criterion for selecting a computer system. Even if system A is twice as fast as system B, you should still give careful consideration to concerns such as cost, documentation, service arrangements, software

availability, user groups, and so on. These benchmarks provide just a small portion of the overall picture.

Benchmarks for Printers

When it comes to printers, you may not always be able to use a BASIC program as a benchmark to evaluate speeds. The BASIC program loop we used in our first benchmark ran at about 300 times per second (depending upon the system). A similar loop for outputting characters to a printer would yield about 300 characters per second (or 225 lines per minute at 80 characters per line). That's fine for all but the fastest microcomputer printers, but be aware that you might have to go to an assembly-language or compiled program to test printers that print more than 300 characters per second.

Another thing to watch for when testing printers is the actual speed of a serial or RS-232C port. Parallel connections pass 8 bits of data (one character) at a time, and a parallel printer will accept characters as fast as the BASIC program can provide them.

If you're dealing with a serial (RS-232C) printer, however, the 8 bits that make up each character are first converted to a stream of 10 or 11 bits and sent along one line. The speed at which the bits are sent depends on the bits-per-second (bps) rate of the printer; most serial printers operate at 300, 600, or 1200 bps, corresponding to 30, 60, or 120 characters per second. If you want to apply a benchmark to a serial printer, make certain that the rated speed of the printer in characters per second is less than its bps rate divided by 10. Otherwise, the printer's speed will be limited by its bps rate. An 80-character-per-second printer, for example, would have to run at 1200 bps (120 characters per second); an RS-232C speed of 600 bps (60 characters per second) would not be able to keep up with the rated print speed.

With these provisos in mind, here's a BASIC loop that can be used as a benchmark for printers:

```
100 A$="ABCDEFGHIJKLMNOPQRSTUVW
      XYZabcdefghijklmnopqrstuvwxyz
      0123456789!#$%×()*:
      =-<>,./?"
110 LPRINT A$
      (command format may vary)
120 GOTO 110
```

The first line has 79 characters and is entered as a single unit (no carriage returns within the string). You can use your own characters if you wish, but almost all printers now provide upper- and lowercase and the special characters included in the line above.

This benchmark just prints the 79-character line over and over. The program is more than fast enough to keep up with 300 character-per-second printers. Running the program for 60 seconds will give you the number of 79-character lines per minute.

Generally, the longer the printed line, the faster the lines-per-minute rating. The reason for this is that the carriage return to the left side of the paper takes a relatively long time in comparison to printing characters. The longer the line, the less effect the carriage return has. (We've avoided 80 characters here because you may get an automatic linefeed after 80 characters on some printers.) To see the effect of shorter lines, change A$ to a shorter string and run the benchmark again, timing it as you would the longer line.

Almost all printers are now *buffered*. This means that they contain an internal memory that accumulates characters as fast as BASIC can spit them out, at least until the buffer is full. From that point on, the buffer will feed the printer mechanism at the maximum mechanical speed of the printer, which is the limiting factor

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of a printer's speed. You can see this effect by stopping the BASIC program and noting that the printer keeps on printing for a few seconds or longer, depending on the size of the buffer. Run the benchmark for at least 60 seconds and count the number of lines from start to stop of the program, not to the termination of printing.

Another good benchmark for a printer is several pages of a word-processing document. Run the same document for a variety of printers and observe the elapsed time for each. The only potential problem with this approach is that in some cases the word-processing program may not be able to keep up with the printer, but this should be rare. If there is a delay between the time the word-processing system ends (and is ready for the next command) and the moment the printer stops, you know that the word-processing program has spewed out characters faster than the line printer can handle them and that the test should be valid.

The benchmarks described above test the general speed of a printer. Today's printers, however, are so intelligent that they may have a variety of other functions that could also affect their speeds—underlining, proportional spacing, bold printing by overstriking, graphics, and other special capabilities. It's hard to provide a generalized test for all cases, so you'll have to modify our simple benchmark program to test these features on individual printers. Also, print speeds are sometimes given for condensed type, so be aware of special conditions for printer ratings.

For comparison, here are the results for some of the printers we tested using our simple benchmark (lines per minute, characters per minute, and characters per second are abbreviated as lpm, cpm, and cps respectively):

Toshiba P1350: 92 lpm (7268 cpm or 121 cps, rated by manufacturer at 160 cps)

Epson MX-80: 43 lpm (3397 cpm or 56 cps, rated at 80 cps)

NEC Spinwriter: 30.5 lpm (2409 cpm or 40 cps, rated at 55 cps)

Again, speed is a factor to use when evaluating printers, but it shouldn't be the sole criterion for purchase.

Other Benchmarks

We've been discussing some very elementary benchmarks here, ones that give you the most rudimentary information about system speeds. Other benchmarks can be designed, of course. For instance, you might want to test not only how fast a system is, but also how much memory it uses during data processing in BASIC arrays or handling BASIC strings. More elaborate benchmarks would exhaustively test all elements of a BASIC interpreter or compiler or exercise all printer functions. One common benchmark is a prime number generator that generates all prime numbers over a range by a simple yet time-consuming test called the sieve method.

If you decide to design your own benchmark, keep these guidelines in mind so that no bias enters into the testing:

- Try to compare systems of the same configuration as much as possible (even though we've broken this rule above by comparing a Timex TS1000 with an IBM PC). This means that the amount of random-access memory (RAM) should be approximately the same, the number of disk drives should be the same, and so forth.
- If running a BASIC benchmark, start with a "clean" BASIC program configuration. No other programs should be in RAM at the same time as your benchmark.
- Try to keep a BASIC benchmark program identical as far as the number of BASIC statements per line, number of lines, variable names, and so forth. All BASIC dialects are not identical, but many of them share similar commands, especially those in Microsoft BASIC.
- When using variables in BASIC benchmarks, bear in mind that different systems use different variable types and degrees of precision. The Radio Shack Model 100, for example, uses an internal representation of numbers called binary-coded-decimal (BCD), which is quite a bit different from other BASICs. If your benchmark contains a lot of number crunching, you may want to make certain that numbers of the same degree of precision are being handled; it's not fair to compare one system that handles 14 digits of precision with another that handles only 7.
- Avoid screen printing as much as possible. Displaying text on the screen is time consuming and may degrade the speed of processing (it takes time for the BASIC interpreter to format and display data on the screen). Of course, you may want to run benchmarks on screen-display operations themselves.
- When doing disk-related benchmarks, start with a "clean" disk, one that contains either no files or at least a minimum number of files. If there is just a little bit of space left on the disk, the file management portion of BASIC may have to spend a great deal of time shuffling data around.
- Make the benchmark tests as long as possible. You can't really compare two systems if your results are in fractions of a second. It's better to have a benchmark run for several minutes. This is especially true if you're using random data generated by the benchmark program.

If you keep these cautions in mind, you'll find that benchmarks can be valuable tools for evaluating both processors and peripheral equipment. Some people might say that by the time you finally know enough to run a fair benchmark, you already know enough about the system to have dispensed with any benchmarks. Try some and judge for yourself! □

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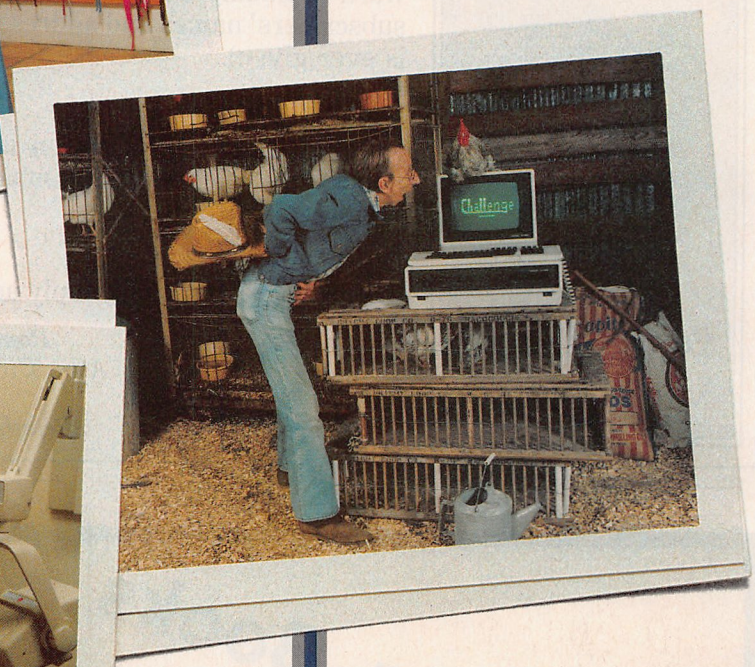

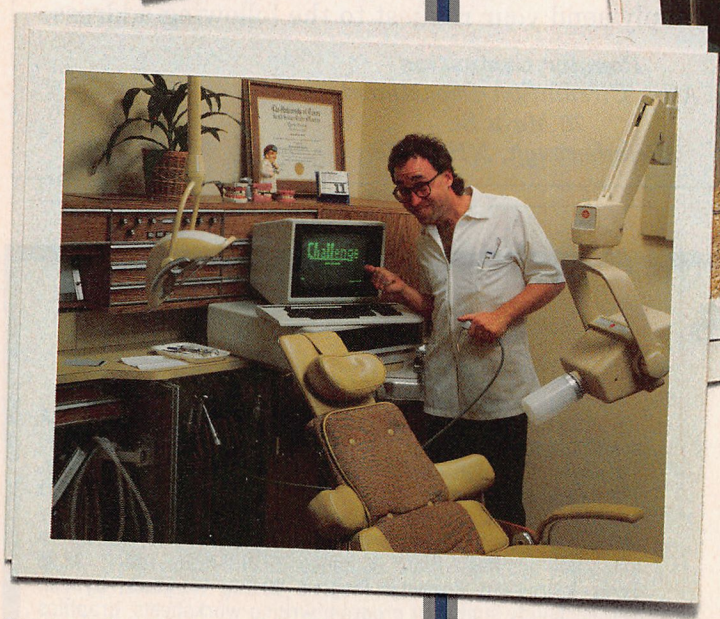

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Mind-Mirroring Software

Ambitious programs that reveal problem-solving processes

by Dan Watt

One of the classic unresolved conflicts in education concerns the issue of process versus product. How much time and effort should be devoted to learning specific facts and procedures as opposed to learning how to learn? Traditionally, the emphasis has fallen on the side of product. Students are expected to spell accurately whether they know the basic principles of English spelling or not, they are expected to do arithmetic correctly whether or not they comprehend the logic of the solution, and they are expected to write and speak properly without necessarily understanding grammar and syntax. Ultimately, people are expected to learn these things—and much more—without fully fathoming how learning happens or how their own minds work.

On the other hand, some educators have always stressed the importance of understanding the *process* of learning. It has been argued that the person who understands how knowledge is assimilated will find it easier to learn new subjects and will, in general, be a freer, stronger, more effective citizen than someone whose education has been limited to the mastery of particular skills and facts. Nevertheless, specific learning predominates in educational institutions; the process of learning always seems to take a backseat.

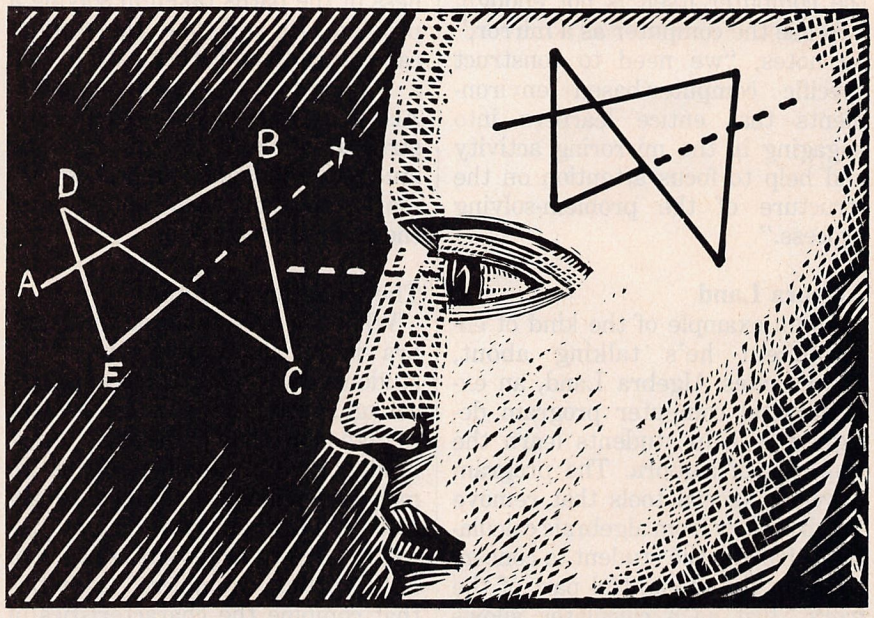

Illustration by Anthony Russo

Perhaps the most difficult aspect of learning how we learn is cerebral opaqueness—the problem of identifying exactly what goes on inside a person's mind. We know precious little about how experts solve problems in their respective fields and even less about how naive learners solve problems intuitively. Research in these areas could begin in earnest if only we could make thought processes *visible*.

The Scholar's Notepad

John Seeley Brown heads a research group in cognitive and instructional sciences at the Xerox Palo Alto Research Center (PARC), the high-powered California think tank that developed the computer language Smalltalk. To solve this problem of making knowledge and learning visible, his group is refining a concept that he calls "the scholar's notepad"—a powerful computer system that combines a word processor with an annotation system and a set of specialized problem-solving tools. This system is able to record every step and annotation in the solution of a particular problem. Such notepads could prove very useful both to experts in specific fields as well as to fledgling learners tackling a problem for the first time.

This sort of learning analysis, whether for scholars or novices,

Dan Watt is a *Popular Computing* contributing editor.

would provide what Brown calls an "audit trail" of the learner's thoughts. Brown says that such a record could *reify* the process of thinking—that is, transform it "into an object or product in its own right, something that can be studied, browsed through, and manipulated." These cerebral audit trails could be used by researchers trying to understand how experts solve problems, by teachers studying the learning styles of their students, and most important, by students themselves.

Brown cautions, however, that the computer itself is not enough. "To use the computer as a mirror," he notes, "we need to construct specific computer-based environments that entice learners into engaging in the mirroring activity and help to focus attention on the structure of the problem-solving process."

Algebra Land

As an example of the kind of environment he's talking about, Brown cites Algebra Land, an experimental computer program designed to help students learn the concepts of algebra. The program provides special tools that remove the drudgery from algebraic calculations, freeing the student to concentrate on the thoughtful part of the work. Just as a calculator allows someone to specify operations and numbers and leave the actual calculations to the machine, the tools of Algebra Land let the user specify the *process* to be used, whether it be factoring, canceling, or simplifying. Once the process has been selected, the computer carries it out and displays the result. The student needn't worry about careless errors and can concentrate instead on the methods he or she is using to solve the problem.

Even if it did nothing but provide these tools, Algebra Land could still make a powerful contribution to the study of algebra. Because the program helps the student separate the strategic from the tactical, it highlights an important aspect of algebraic problem solving that many students never recognize when they're bogged down in detailed calculations. This could lead to what psychologists call *metaknowledge*—insights into the principles of algebra that are on a higher plane than simply being able to *do* particular problems.

The most important feature of Algebra Land, however, is that it keeps track of everything the student does and displays it on a high-resolution screen. Students can see all the choices they've made and thus have a heightened awareness of the paths taken in solving a problem. At any time, the student can return to an earlier path to find a quicker or easier solution. According to Brown, the shapes and structures used to display the student's thought processes are more important than the listing of the choices themselves.

The Robotics Olympics

While we may all agree that algebra is an important subject for students growing up in a technological age, getting an average student to take more than a cursory interest in algebra is an uphill struggle. To motivate millions of students to pay attention to their own thought processes, Brown urges the creation of a "Robotics Olympics," activities that combine the characteristics of video games, team sports, and computer programming. "What we want to do is find a set of activities in which the kids are already masters at problem solving so they can look at their own learning strategies. The Robotics Olympics is a collection of programming environments that force kids to make their strategic and tactical knowledge absolutely explicit. Sociologically, we're trying to transform the current craze for arcade games into something that's more conducive to learning," he says.

Robotics Olympics involves creating simulations in which one team of computer-controlled players faces off against another. The difference between this environment and arcade games is that instead of playing the game yourself, you play it indirectly by creating small programs that specify what the robot players on your team should do in every possible situation.

"Think about Monday-morning quarterbacking," Brown suggests. "What happens is that you analyze the thinking of the quarterback and say, 'If I had been there, I would have done X.' Our idea lets you go one step further and say, 'Let's see what happens if I *do* X.' Now you write a little program for the machine and suddenly realize that what you just said was hopelessly underspecified. So you have to go back and reflect on the exact conditions in which you would have done X. You're forced to make precise diagnostic strategies for things that are normally vague and intuitive. How do you tell if another player is faking, for example? We have a lot of intuitive rules for that kind of situation, but this gives us a chance to try to make them precise.

"All of this would be connected to a kind of scholar's workstation," Brown continues. "Kids would be encouraged to keep notes in their electronic notebooks to communicate with their teammates about what they'd done. There's an interesting recursive opportunity here. Suppose one player writes a program for the quarterback and another guy programs the running back. You'd have to establish protocols for the two robots to communicate *as programs*, and the players would need to establish protocols for talking to each other as programmers. Two students would therefore be communicating on one level about how their automated players are communicating on another level."

Mirrors on the Market

John Seeley Brown's systems are created with a $25,000 Xerox Scientific Information Processor, a computer with a 16-bit processor and 1½ megabytes of memory. Brown feels that computers in this price range are now "practical" for

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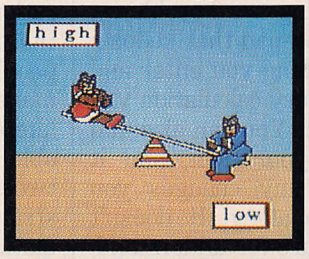

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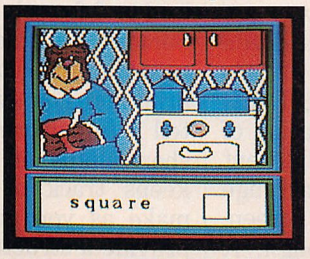

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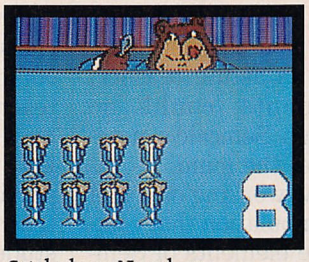

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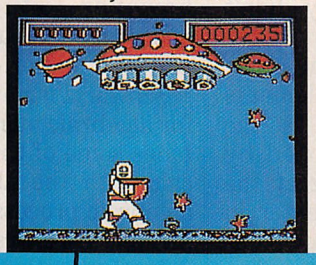

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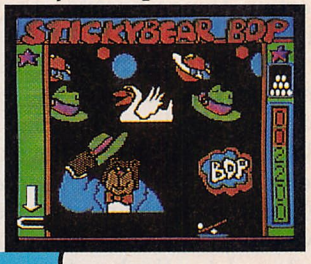

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research and development. Meanwhile, other developers are creating mind-mirroring software that runs on more affordable computers. Thinktank, produced for the Apple II by Living Videotext Inc. of Palo Alto, California, is an organizational tool for writers and managers. To be used primarily for creating and modifying hierarchical outlines, Thinktank is also being promoted as "the first idea processor."

David Greene, vice-president of the company, describes the way Thinktank can be used to sharpen one's thought processes: "When I first used Thinktank, I was writing a proposal for a curriculum to teach problem solving. The whole idea was so ill-defined that I was approaching it in about half a dozen ways at once. When I put all this information into Thinktank, I was able to try out the organization of ideas at three or four different levels of complexity and rearrange them in front of me on one screen. That provided a breakthrough. It let me see that certain combinations of ideas would work while others wouldn't and that I had to leave out certain things because they didn't fit at all."

Another software tool that incorporates some of the elements of the scholar's notepad is the Semantic Calculator developed by researcher Judah Schwartz at the Education Development Center in Newton, Massachusetts, and distributed by Sunburst Communications of Pleasantville, New York. Semcalc, as the product is nicknamed, is a tool designed specifically for elementary and junior high school students who have to solve arithmetic word problems such as "If you had 15 oranges to share with 7 friends, how many oranges could each person have?"

To use Semcalc, you enter items and specify operations and the calculator prints the result. Unlike an ordinary calculator, however, Semcalc requires that you specify the *units* of each item and carries these units along in its calculations. For the problem given above, you would enter "15 oranges" and "7 friends." Suppose you then tell the program to multiply. When it gives you the result ("105 oranges-friends"), the strange units provide an important clue that perhaps multiplying was not the correct approach. If you now tell Semcalc to divide, the result will be "2.1428571 oranges/friends," which is a more appropriate solution. If you tell Semcalc to *add* oranges and friends, it will ask, "Oranges and friends are both what?" This prompts you to recognize the need for a new unit, and if you tell it "objects," it will dutifully compute "15 objects + 7 objects = 22 objects."

In addition to providing a specialized tool for solving word problems, Semcalc has a notepad that keeps a record of everything you enter and brief notes on every calculation you tell it to perform. You can also add short notes of your own, and it keeps track of any changes you make as you go along. It doesn't provide a structure for understanding your process, nor does it display the notes unless you ask for them. In the hands of an astute teacher, however, students could be encouraged to use Semcalc's notepad as a mirror of the mind.

Schwartz is now working on a tool for algebraic manipulation that combines some of the elements of Semcalc with the ability to carry out algebraic processes flawlessly. This means that a first approximation of John Seeley Brown's Algebra Land may become publicly available within a year or so.

Will Educators Respond?

Will "mirroring the mind" ever become a practical component of everyday learning? The habit of stressing product over process is so deeply ingrained in American education that it will be difficult to alter it, even with the most extraordinary software. Tools like Semcalc and Algebra Land may improve students' abilities in mathematics without necessarily leading them to understand more about their own thinking. If process is going to triumph over product, we'll have to see major changes in the attitudes of teachers, curriculum developers, school administrators, and test makers.

Even if mind-mirroring tools are never widely used by students, I believe they can make a large, though indirect, contribution to education in a number of ways. Researchers will be the first to adopt these powerful tools in their study of both the problem-solving methods of experts as well as the learning habits of novices. The better insights such research provides should lead to improved teaching approaches in the long run. But it's likely that the most important application of mental mirrors will be in the realm of teacher training. If people preparing to teach algebra make extensive use of programs like Algebra Land, they'll be better able to spot the distinctions between successful problem-solving strategies and rote algebraic manipulation.

Finally, software that provides clues about a student's thinking could be vitally important to teachers, who are frequently baffled by a student's fitful progress. If a kid were having trouble with a particular kind of problem, the teacher could examine not only the student's responses but also the methods used to obtain them.

It takes a lot of courage to look into a mirror, especially when that mirror gives us an undistorted reflection of the mind's inner workings—those mysterious journeys that get the learner from problem to solution. As researchers and programmers strive to make these tools more practical and accessible, educators must be courageous enough to explore the potential that the mind-mirroring software has to offer. If teachers don't shy away from the challenge, we may one day witness the educational revolution that has been predicted since the invention of the computer, the revolution that so far has always seemed to lie somewhere just beyond our view. □

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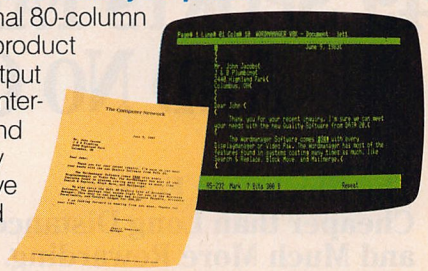

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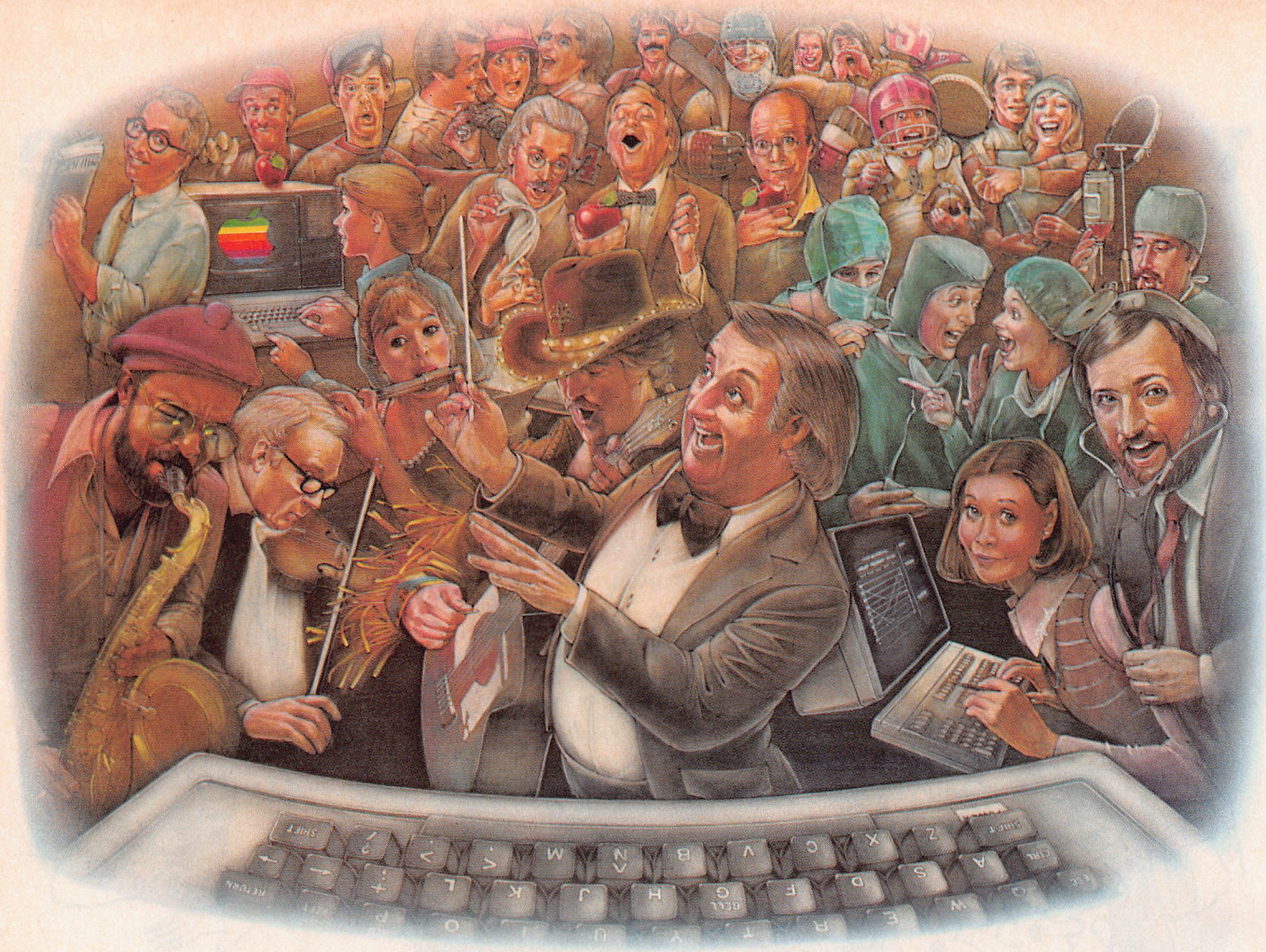

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Cutting On-Line Costs

Expert tips on working smart while the on-line meter is running

by Steven Levy

As a noted time-waster, I never liked it when people admonished me that "time is money." The implication is that if you aren't spending your time in some financially constructive application, you're losing money. This may well have been true in my case. But then, I always thought time was a lot better than money. Others obviously feel the same way. I cite as proof the dreams people have of striking it rich—they imagine using the money for activities that would require them to spend time extravagantly and nonconstructively, often on or near beaches.

I admit, though, that my hard-line stance against the time-is-money crowd has been eroding of late. You see, I've been spending much of my precious time connected to various databases and telecommunications services. In these instances time is indeed money, and at the end of every month a bill comes to squelch any lingering philosophical doubts. Sure enough, down to the minute, my on-line time is documented and totaled according to whatever Compuserve or EIES or whoever thinks time is worth these days. Even my use of "free" user-operated bulletin boards comes down to the time-money equation because so many of the interesting services require long-distance calls, and as we all know, no institution has been as responsible for hammering the time-is-money creed into our consciousness as Ma Bell.

As a result, I've adjusted my on-line behavior to keep costs down and credit lines up. And I've done some thinking about other ways to save on-line time, and, therefore, money. For a few more ideas, I called up this month's special guest telecommunications expert, Barbara Newlin, director of research for Information on Demand, a researching service based in Berkeley, California. Barbara accesses hundreds of databases in search of esoteric shards of information. I figured that she must be aware of lots of canny little techniques to reduce on-line time to the absolute barest minimum. Let me share both the obvious and the obscure techniques in hopes that your on-line time will be money well spent.

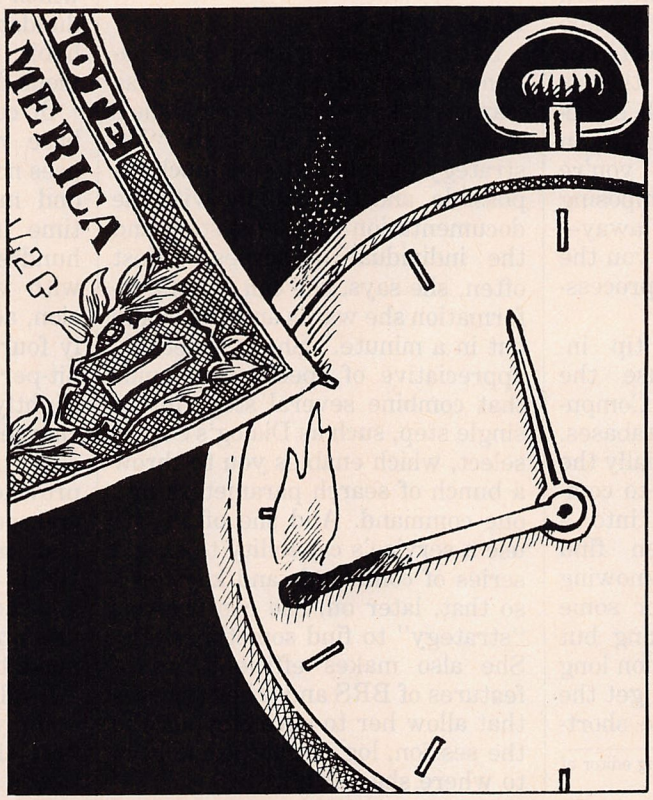

Illustration by Jean-Francois Allaux

Do It Off Line

First of all, you must remember that big savings come only by minimizing the time you spend actually connected to the service or database. Anything you can do off line should be done before you log on. If you get stuck on something, don't be reluctant to log off, figure out what you're doing, and log back on. Try to think of your time on line as a trip to the post office rather than a visit to the library.

(The difference, I guess, is that no one likes to spend much time in a post office, while being on line can be rather pleasant.) Conduct your business and split. There's plenty of time off line to write letters, read your mail, and figure out what kind of information you're going to want next. This can best be done if you have some really good terminal software that allows you to easily capture your on-line sessions and even do some editing while still connected. Whether you keep your printer on while you're on line or whether you save selected portions of the session on disk (as I do), you'll find it much more economical to puzzle over your new information in the leisure that follows log-off.

Conduct your business and split. Use off-line time to write letters or figure out what kind of information you're going to want next.

Likewise, composing long electronic letters or bulletin-board messages should be done off line and then sent with the help of your terminal software. While there's often a temptation to dash something off when it occurs to you in the middle of a session, you're almost always better off composing without that meter ticking away—and working off line gives you the benefit of your own word-processing software too.

Another money-saving tip involves the way you use the manuals for The Source, Compuserve, and various other databases. Read them carefully, especially the sections that tell you how to compress a few movements into a single command. I often find myself in the position of knowing that there's a shortcut for some cumbersome path I'm taking but don't want to stop the session long enough to find the manual, get the section that deals with the shortcut, and then hit the commands. Eventually, I look up the information off line and from then on, save lots of time.

For example, I like to look up the baseball scores on Compuserve. Rather than go through the menus one by one until I get to the "page" with AP baseball news, I simply type "APV-5" at any prompt and am instantly delivered to my choice of sport. Another way of saving time is to write a few simple commands to start your on-line session in a certain place, most commonly the electronic mail section. After sitting down with The Source manual one afternoon, I found an easy way to change my log-on procedure so that my mailbox would be checked automatically, seconds after I access the service.

Expert Advice

Barbara Newlin, from Information on Demand, says that she has learned to know exactly what she's going to do before she starts. "My strategy is planned as much as possible, and I'm familiar with the documentation for the system and the individual databases." Most often, she says, she can get the information she wants and "be in and out in a minute." She is especially appreciative of special commands that combine several steps into a single step, such as Dialog's Superselect, which enables you to throw a bunch of search parameters into one command. And she often will use a service's capability to save a series of commands and keywords so that, later on, she can use this "strategy" to find something else. She also makes efficient use of features of BRS and other services that allow her to save her place in the session, log off, and come back to where she left off.

Of course, she knows her stuff, but you can too if you do some homework. In other words, you have to dig a little, learn the ins and outs of the system, and then you'll start saving the dollars. But there are simpler tricks. For instance, Newlin points out that "you should never go on a system when it's experiencing a peak load—the same search I do at 10 in the morning (when it seems everybody in the country is accessing the system) can cost literally five times as much as one done at 4 in the afternoon." (Needless to say, those services that are cheaper when accessed late at night should be used during those low-rent periods.) And Newlin was startled when I mentioned to her how helpful I found it to have a pencil and some paper with you when you're on line—so you can catch crucial numbers and reference points the first and only time around. "I'm never without pencil and paper," she said, making me a little embarrassed to remember that it took me about 30 sessions or so, during which I was loaded with on-line redundancies, before I got into that habit, which should have been obvious from the beginning.

Of course, a high-powered database rider like Barbara Newlin uses nothing but a 1200-bit-per-second modem, which saves on-line time in one fell swoop. (Twelve hundred bit-per-second modems, with wonderful arithmetic precision, access those databases exactly four times as swiftly as the 300 bit-per-second units.) Despite the slightly higher rate some services charge for 1200-bit-per-second access, life in the fast-modem lane provides huge savings and increased convenience. But because fast modems require an initial outlay of a few hundred dollars, you should try to figure out if you'd use a high-speed modem enough to make the investment worthwhile.

If all else fails, you might brush up on your typing. It was the very first thing Barbara Newlin mentioned when I asked her what af-

Columnist Steven Levy is a contributing editor of *Popular Computing*.

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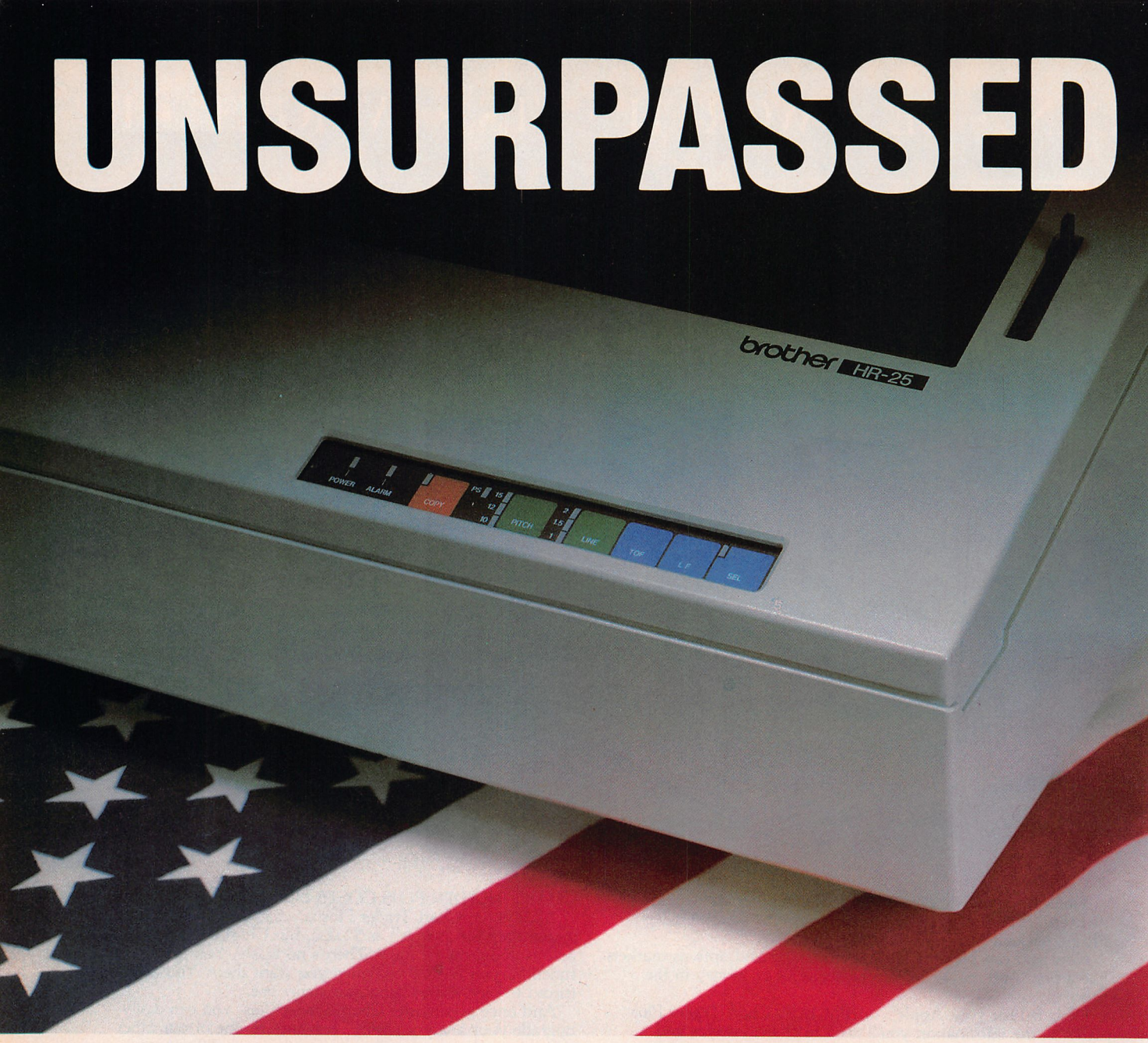

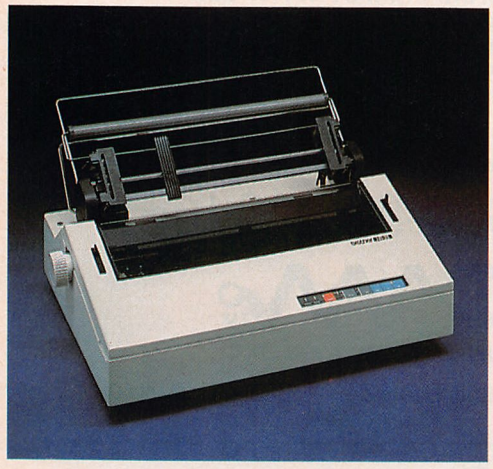

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fected on-line time. "The faster and more accurately you can type, the better off you are," she said. "Someone who types inaccurately might take twice as long, and spend twice as much, on-line." This hit home. As someone who is prone to keyboard errors and no stranger to data services refusing to recognize misspelled keywords or mangled commands, I could see her point. I think I'd save a lot of money if I were to take a typing course. Too bad I don't have the time.

Handbook of the Obvious

Earlier in the column, I mentioned the importance of keeping a pencil and some paper by your side during on-line sessions. At first, I wondered whether that advice might not be just too obvious to mention. But then I came across the same pointed hint in an important new general-interest book about telecommunications. That idea is only one of the extremely obvious, yet essential, hints on making the best use of your on-line time as suggested in *The Complete Handbook of Personal Computer Communications: Everything You Need To Go Online With the World* (St. Martin's Press, New York, 1983) by "a writer and personal-computer consultant" named Alfred Glossbrenner.

Some of the best-selling computer books—which are some of the best-selling books of any kind—are guides to various applications of personal computers, and I've wondered why it has taken so long to get a good, hands-on guide to telecommunications. Biased though I may be, it seems that telecommunications, including bulletin-board database accessing and hanging out on The Source, is the most populist use for computer owners. Word processing, to which authors have devoted about a million or so books (they have to use those word processors for something, I guess) is comparatively difficult and of limited value for those who don't do much writing; also, many low-end personal computers don't offer very much in the way of efficient word processing.

Not so with telecommunications: it's fun and you can communicate over the wires just as easily with a Commodore VIC-20 as with an IBM Personal Computer. Yet I am astounded at how many computer owners I meet who say that they just haven't gotten around to getting a modem. "I hear it's interesting," they'll say. "But what can you do with it, really?"

For those people, Glossbrenner's book will be valuable. It's a strong primer on the basic services available to plain old users with modems. As his meticulous inclusion of the Old Pencil Trick indicates, he is best at reiterating the obvious. In his brief (too brief) chapter on troubleshooting, for instance, he walks you through steps like an indulgent parent coaxing an anxious toddler across the room. You say the letters on the screen look like gibberish, and you can't see them at all? Before you start calling Novation and angrily demand a refund, take a deep breath. Is your modem plugged in? Is it turned on? Is everything else connected properly? Are you wearing your glasses? (The last one, I admit, even Glossbrenner didn't have the nerve to ask.) This is necessary stuff, and as such is welcome, but it takes up a lot of space. And it is indicative of the "make lists" mentality that prevades this book.

What's a Null?

Before I enter the critical mode, I'd like to mention a few of Glossbrenner's triumphs. First of all, he tells us what nulls are. For months now, I'd been dreading the day when someone would approach me and say, "Hey, Steve, you write a telecommunications column—why don't you tell me what a null is?" I would have been forced to cast my eyes to the ground and mumble faint apologies. All I knew about nulls was that I didn't need them.

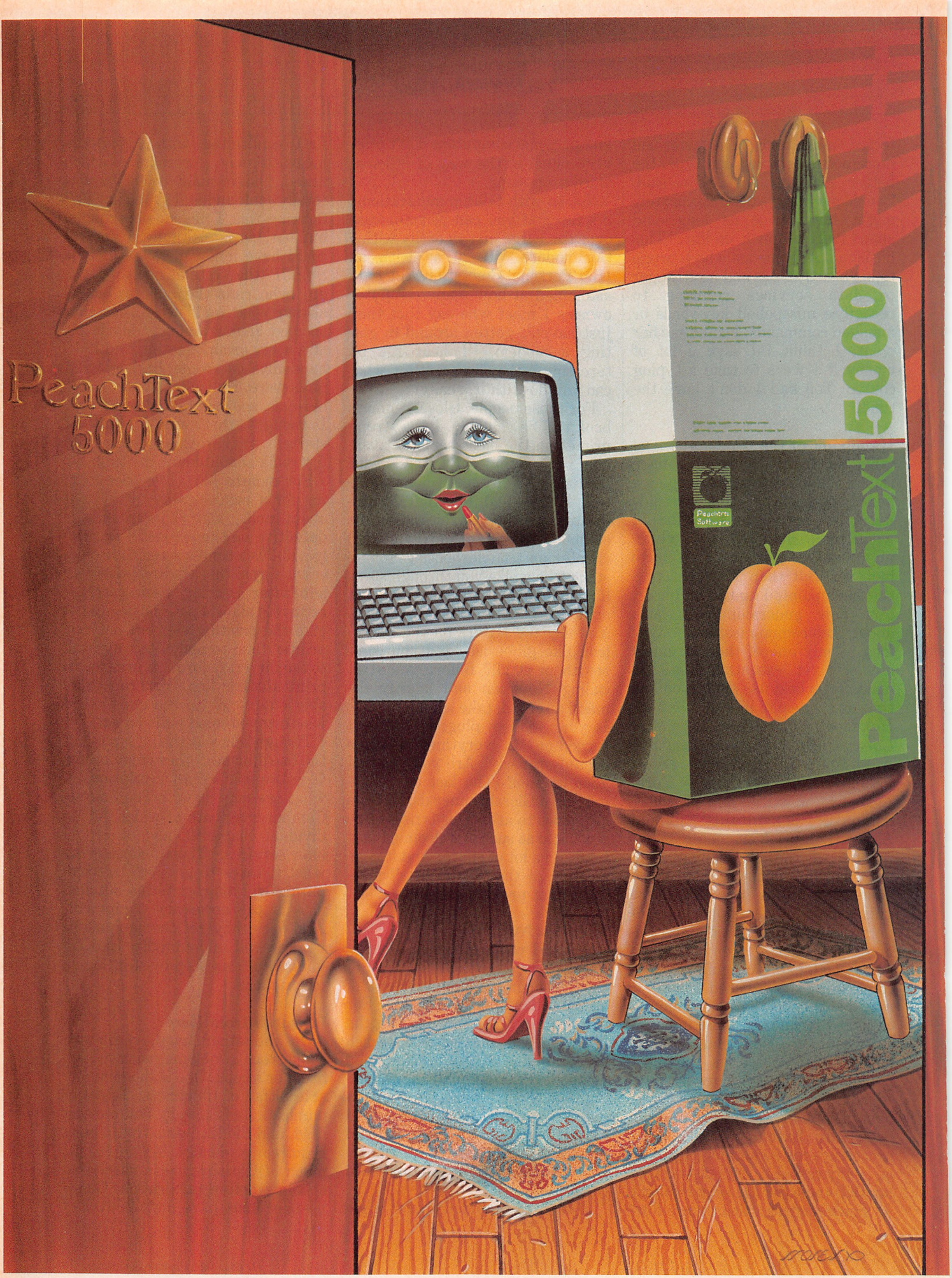
It used to be even worse: when first confronted with a bulletin-board sign-on procedure which asked, "no. of nulls (0–50)?" I was totally confounded. I typed in "10," figuring that I needed *some* nulls, but not *too many* nulls. I knew I could have left a message for the SYSOP (the systems operator, the guy who runs the bulletin board) asking what nulls were, but that seemed embarrassing. Only later, at a users group meeting, did I offhandedly ask some hacker what nulls were. He looked at me, rolled his eyes, and said I didn't need any. I thought that was it, until I started writing this column and figured I should know my nulls.

For months now, I've been looking for a painless way to find out about nulls, and Glossbrenner is definitive on the subject: "Basically a null is a time-waster. It is a no-count signal that the computer can add after sending each carriage return to allow a pause designed to give the printing element on your printer time to make its way back to the far left before it is ordered to print another line. You can probably enter 'no' (to the question of whether you need nulls or not)."

Though this was the high point of the book for me, others may prefer Glossbrenner's fine descriptions of what one may do with The Source, Compuserve (both of which get individual chapters), and other on-line services. Those considering what it takes to get into telecomputing will appreciate his detailed lists of the necessary equipment. And once they get the equipment, novices will undoubtedly take advantage of his step-by-step log-on instructions.

Downhill from Here

On the other hand, there are some real problems with Glossbrenner's book. One is the unavoidable pitfall of timeliness. Telecommunications is a very fast-moving field, and the lead time that a book requires is deadly. As a result, much of Glossbrenner's work was obsolete before publication. Glossbrenner must have just about died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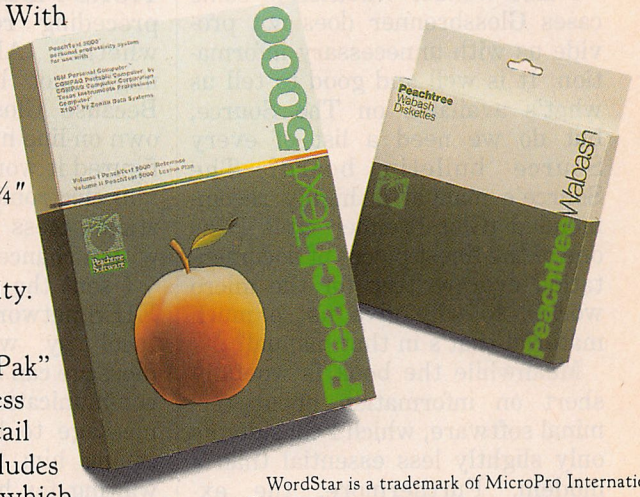

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when he learned that the New York Times Information Bank shut down early this year—he devotes half a chapter to it. Also, Glossbrenner's predilection for lists and sources, while effective in filling the book to its deceptively hefty 325 pages, makes the book a conduit of some misinformation. I randomly called some of the numbers listed in *Personal Computer Communications*, and many of them didn't work anymore. Glossbrenner, with his excellent grasp of how fast things change (he's always going on about "the revolution" in telecommunications), should have known better.

I also wonder whether in some cases Glossbrenner does not provide us with unnecessary information. It is well and good to tell us what's available on The Source, but do we need a list of every Source bulletin board? The Source's manual is highly recommended (Glossbrenner cites it as one of the finest pieces of documentation ever written for the micro world), so why give us so much material that's in that manual?

Meanwhile the book is woefully short on information about terminal software, which I consider as only slightly less essential than a modem. Furthermore, the examples provided by Glossbrenner are rather mundane, the stuff of Sunday newspaper features. Couldn't Glossbrenner have given us a look inside a SYSOP's head to let us see the real passion in this field? There is a genuine lack of writing on the magical aspects of telecommunications, and I wish Glossbrenner, who knows his subject, shared it with us in a more ambitious fashion.

My final complaint is price. Who says that computer books, just because they're computer books, should cost more? *Personal Computer Communications* is a trade paperback that lists for $14.95. I would suspect that the potential marketplace is sufficiently large so that costs can easily be made up by pricing the book in the same range as noncomputer trade books, that is, about half its price. Somehow publishers (St. Martin's is far from the only offender) must believe that computer owners are willing to pay more for books, and thereby feel free to gouge.

When asked for the number of nulls I required, I was totally confounded. I typed in 10, figuring I needed some nulls, but not too many nulls.

Instant Feedback

EXTRA! TELECOMMUNICATIONS FLASH! After I wrote the preceding review, I wondered whether Alfred Glossbrenner might not like to reply to it. Because Glossbrenner prints his own on-line numbers in the book, I figured it would be easy to contact him electronically and give him instant access to the review, along with a chance to respond.

I sent the review to him on the EIES network, using a handy protocol by which a fairly long message can be tagged onto a short communication. I also sent a quick message to him via Source Mail, telling him that the review was waiting for him on EIES. Then I waited. The EIES system automatically informed me my message had been read. When I later accessed The Source Alfred Glossbrenner's response to my review was there. Here's what he said:

"For most people, telecommunications may very well be *the* best reason for buying a personal computer. Never has so much information and so much communications power been so easily available to so many people. The potential is positively mind boggling, and it's all there right now.

"The problem is, as Steven points out, most people aren't aware of everything that's out there, much less how to make the most of it. A Gallup poll recently published in *The New York Times* (May 11, 1983) indicates that only about 14 percent of computer owners currently use their systems for communications. At the same time, a new study by the high-tech research firm International Resource Development claims that not only do modems and data communications software constitute the fastest-growing segment of the personal computer market, they are likely to continue to do so, with predicted sales growing by more than 60 percent in each of the next five years.

"If you're among the 14 percent who have a modem, you know there's a desperate need for solid information on communications. But the need is even more acute if you're among the 86 percent who have not yet gone on line. How do you know which databases to choose? What can you expect? What can you do with it? Did you know that you can send Telex and TWX messages? Do you know how to get free software—on line? What other possibilities are open to you? It was to answer these and many other questions that *The Complete Handbook of Personal Computer Communications* was written."

I copied this reply off The Source, reformatted it on my computer using Wordstar (no retyping was necessary), and sent it to *Popular Computing* via The Source as a coda to my column in time to make this issue. Is this some historical journalistic milestone? Probably not. However, I'm glad to have given Glossbrenner space to respond and take particular pleasure in the fact that we did it by "personal computer communications."

On-Line Critique of WarGames

This just in from the bulletin-board underground. The movie

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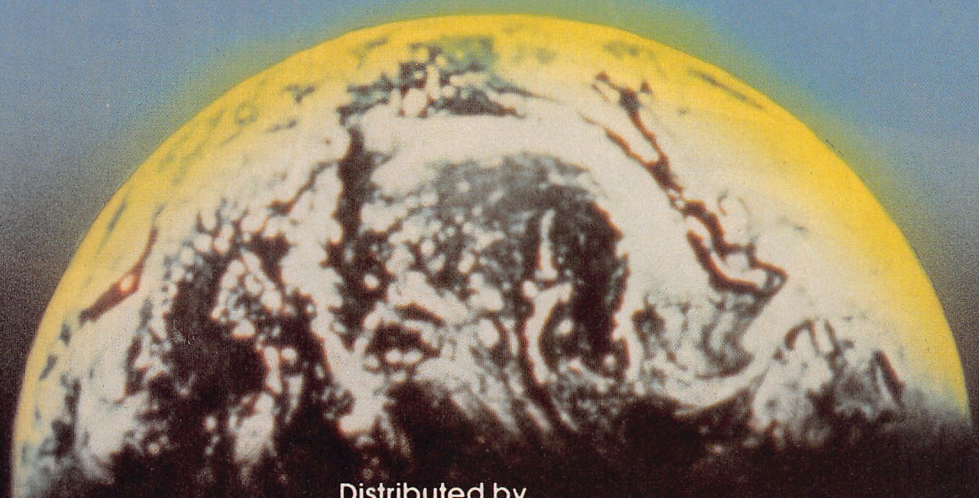

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WarGames may not have outgrossed *Return of the Jedi* this summer, but it was far and away the number one flick in terms of comments on computer bulletin boards. Those who accessed these privately run, no-charge-for-usage electronic message centers contributed to discussions that focused more on the film's technical gaffes than its dramatic content.

WarGames, you'll remember, concerns a shy high school hacker's inadvertent break-in to the Pentagon's high-security warfare computer. While it's accepted as a truism that no computer system is unbreakable, on-line critics have complained about how easy it was for the youngster to break in. After using the common trick of setting up his computer to scan numbers in search of a computer signal, he only had to figure out a rather obvious password to get access to the ultra-secret supercomputer. This detail seems particularly offensive to those who know how much work it is to break into even a moderately protected system.

But the biggest moans were generated by the young hacker's equipment. Many asked how he could afford such an extensive outfit, which included several disk drives; a huge, high-resolution monitor; a 1200-bit-per-second modem; and a data-to-voice package that is slightly better than the best our scientists have come up with to date.

Some people questioned the hacker's use of an ancient IMSAI computer as his main module; others guessed that the inclusion was due to the switches and flashing lights on the machine's front panel. Everyone was offended that the protagonist, with all his sophisticated equipment, used an acoustic modem connection that hooked on the phone receiver rather than the more reliable direct connection to the phone line. And one person carped that the hacker's reception rate seemed even faster than what you'd get with a 1200-bit-per-second modem.

Even though the film's producers didn't satisfy the bulletin-boarders' penchant for technical verisimilitude, most who commented conceded that compromises might have been necessary to make the computer scenes more dramatic. And almost every comment I read attacking some technical point was amended by a recommendation to go see the film: despite the unrealistic hardware, the on-line critics thought that *WarGames* was a lot of fun. □

Author's Note—Steven Levy welcomes your comments, hints, and suggestions about telecomputing. You can contact him on The Source (ID TCT670), Compuserve (ID 72065,635), or by writing to Telecomputing, POB 397, Hancock, NH 03449.

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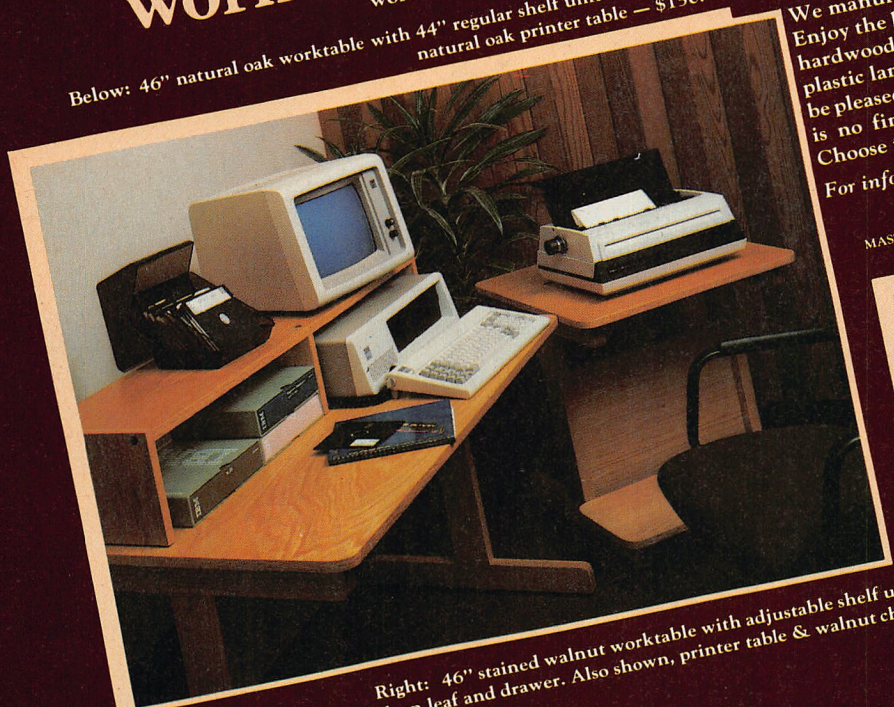

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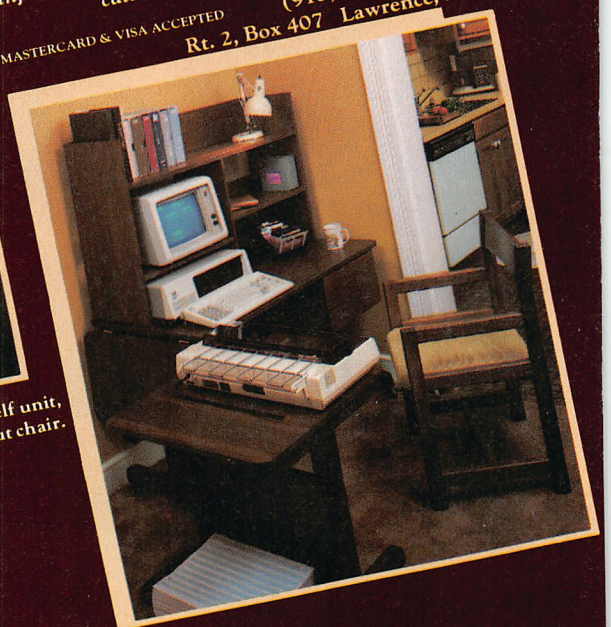

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POPULAR REVIEWS:

A desktop machine that's stiff competition for the IBM PC

THE TEXAS INSTRUMENTS Professional Computer

by Robb Aley Allan

The dust is still settling after Texas Instruments' ill-fated marketing slugfest with Commodore to see who could give away the most home computers the fastest. TI lost that round to the tune of $100 million. As its next opponent, this time in the hotly contested business arena, TI is after none other than IBM.

Still reeling from its losses, TI is in desperate need of a winner. The company is gambling heavily that, by building a machine better than the IBM Personal Computer and by pricing it more competitively, it will win the next round.

On the surface, TI's new Professional Computer seems to be little more than another IBM Personal Computer (PC) clone, similar in profile and overall technical design. TI even went with the Intel 8088 microprocessor that's at the heart of the IBM PC rather than taking advantage of its own great in-house chip-making capabilities. On closer examination, though, TI has neatly sidestepped nearly every limitation that has marred the PC's reputation. The Professional has superior graphics, a better keyboard, more flexible input/output circuitry, and a raft of options including the state-of-the-art technology it may become best known for: speech synthesis and recognition. This is the machine IBM should have designed. It is the optimum personal computer.

The Professional Computer's notable features include high-resolution monochrome or color monitors, a built-in printer port and floppy-disk-drive controller, optional 5- or 10-megabyte Winchester drives, a lightweight, durable keyboard, an optional high-speed dot-matrix printer, and the availability of over one hundred of the most significant software packages, including choices for each major operating system. The basic cost is $2595 for a monochrome single-drive system, about $200 less than a similar IBM PC.

Robb Aley Allan is a freelance writer based in New York City.

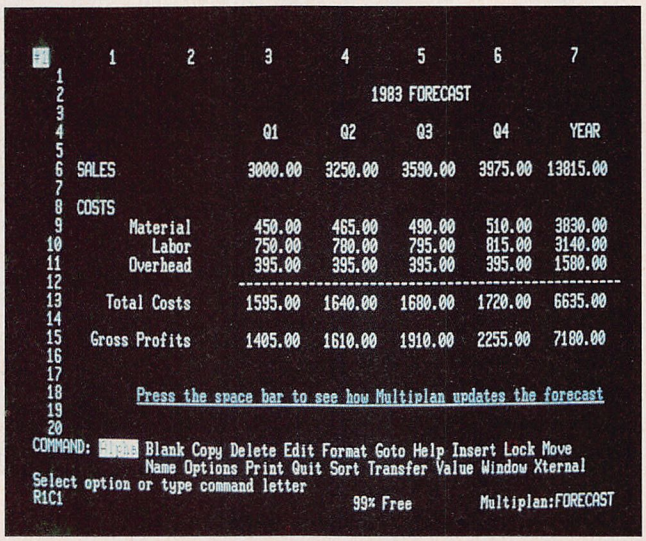
Photograph by Paul Avis

Texas Instruments
Hi-Centering
Bright
Power
Off
On
Texas Instruments
Professional Computer
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
ESC
BACK SPACE
TAB
LINE FEED
CTRL
CAPS LOCK
RETURN
ALT
SHIFT
SHIFT
HOME
INS
DEL
BRK PAUS
PRNT
SPAC
TAB

TI PROFESSIONAL

A monochrome single-drive system costs $2595, about $200 less than a similar IBM PC.

This is not to say the TI Professional is perfect—it does have flaws. But most are minor, and in some cases Texas Instruments has already corrected them in newer models. All things considered (service, software, and options), Texas Instruments' Professional Computer is the best 8088-based system for the money.



More than 100 popular programs like Multiplan are available.

The Main Unit

The metal-cased system unit is about 19 inches wide by 16 inches deep (slightly smaller than the IBM PC) and has openings for two drives (floppy-disk or Winchester) in the front panel. The back plate holds a Centronics-compatible parallel port, male and female three-prong jacks for power cords (one from the wall, one to the monitor), and a round 5-pin DIN jack for the keyboard.

Inside the case, the motherboard contains the 5-MHz Intel 8088 microprocessor, a socket for an 8087 arithmetic coprocessor, 64K bytes of random-access memory (RAM), 8K bytes of read-only memory (ROM) with room for an additional 8K bytes, the floppy-disk controller, switching power supply, fan, 3-inch speaker, and six slots for plug-in option boards. One of these slots is intended to hold a board providing additional RAM—up to 192K bytes in 64K-byte increments. The unit has the capacity for 1 megabyte of RAM, with about 768K bytes for general use and the remainder reserved for the system and option cards. TI has not yet announced the means to make this additional memory available, however.

The arrangement of the option slots, while maximizing the use of space, has one potential drawback: the two outer ones (including the RAM slot) are in line and can accommodate only short boards. TI claims this will not be a problem. Aside from this restriction, option boards designed for the machine can be placed in any of the slots available; the microprocessor automatically senses what is where. Channeling data from a program to a particular board is done by informing the software package at the outset that the board is a certain "port," a designation determined by switches on the board itself.

The fan in the system unit I reviewed was distractingly noisy, competing with the printer for attention. TI officials explain that a shortage of the proper fans during the first production run forced them to use what was available.

Custom Keyboard

The Professional Computer's detachable keyboard is the best I've seen. It tilts in a continuous range from 5 to 15 degrees using a spring-loaded adjustment plate along the back.

The 97 auto-repeating keys are separated into logical groups, avoiding the most frequent complaint about IBM's keyboard. (TI's is about 2 inches wider to accommodate a greater number of keys.) Cursor-control keys form a cross pattern with a Home key in the center—the most obvious location, even though without looking it can be mistaken for an arrow. The numeric keypad on the right is laid out like an adding machine's and features oversized keys for 0 and Enter with additional ones for Space, Tab, Comma, and some basic math functions.

TI chose the standard QWERTY arrangement for its alphanumeric keys. The shift keys are in the normal positions. The Caps Lock button contains a red light-emitting diode (LED), and other keys for special purposes—Ctrl, Alt, Escape, Linefeed, and Backslash, for example—are placed outside the normal typewriter arrangement.

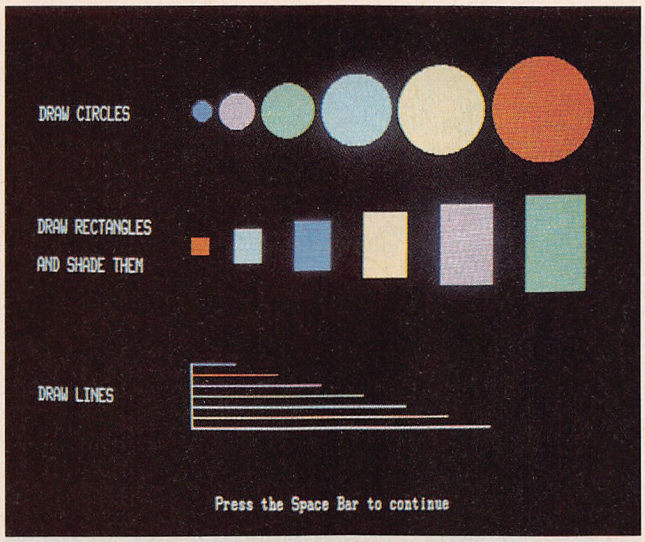
Across the top of the board are twelve programmable keys and four that are predefined: Insert, Delete, Break/Pause, and Print. All are sufficiently far from the QWERTY keys to prevent accidents and are primarily intended for use in applications programs. Pressing Ctrl-Alt-Del simultaneously will cause a "warm" reset, rebooting the system from the disk but not performing power-on diagnostics. The Break/Pause key can interrupt MS-DOS operating system commands. The Print key provides two functions: pressed along with Shift, it

Photographs by Ed Crabtree

dumps the screen display to the printer just like the IBM Print Screen key; pressed alone, the Print key will "echo" text to the printer as it appears on the screen. This allows the MS-DOS Type command, for example, to display the contents of a file on the screen and to make a hard copy at the same time.

The keyboard doesn't employ the usual electromechanical switches to generate keycodes. Rather, it relies on an electronic phenomenon called the Hall effect and uses a coil-and-magnet arrangement. Because of the lack of mechanical parts, tactile feedback—that slight physical snap or click that indicates when a key has been pressed—is simulated with a small rubber cone beneath each key.

TI's engineers referred to recent European studies on the ergonomics of computer design and incorporated many recommended features in the keyboard (partly because this enables the company to market the system abroad). The black-on-white legends are easily seen, and some of the keys have channels (on F and J) or raised dots (on 5) to help the fingers home in. (Unfortunately, the Home key itself has neither.) The concave keys are lightly textured and beveled along the sides. The beveling was somewhat overdone, however, because the area between keys feels enough like the concave surfaces on the keys themselves to cause occasional errors.



Simple commands yield graphics of exceptional resolution.

High-Resolution Monitors

TI has clearly surpassed IBM when it comes to monitors. Both the 12-inch monochrome and the 13-inch RGB color monitors have a high resolution of 720 by 300 pixels (IBM's monitor has a resolution of 640 by 200 pixels). This high resolution allows the display of circles that look like circles and sharp diagonal lines with minimum raster distortion. Each monitor is driven via a different jack on the same controller card; in fact, both sets can be hooked up simultaneously without tying up additional slots or buying different cards. Note that there is no provision for connecting the computer to a standard TV set, however.

The cathode-ray tube (CRT) controller card generates an 80-column by 25-line text display with eight colors. Characters are 7 by 9 pixels in 9 by 12 cells—this leaves two blank pixels between characters and three between lines. The different-colored phosphors on the RGB screen serve to merge the pixels together so that they appear to form solid characters.

Users who want to take advantage of the monitors' high-resolution graphics capabilities must make a choice regarding the degree of color (or black-and-white shading) they want. Two raster graphics cards, either of which can piggyback on the CRT controller card (again saving slots), determine the number of colors or shades available: one card provides two levels (including black) and the other offers eight.

At the time the Professional Computer was announced, the FCC had certified all components except the RGB monitor as Class B devices—usable in the home without causing radio-frequency interference to televisions and radios. The RGB set was certified as Class A—office use only. TI engineers believe that the color monitor will be recertified by the time you read this.

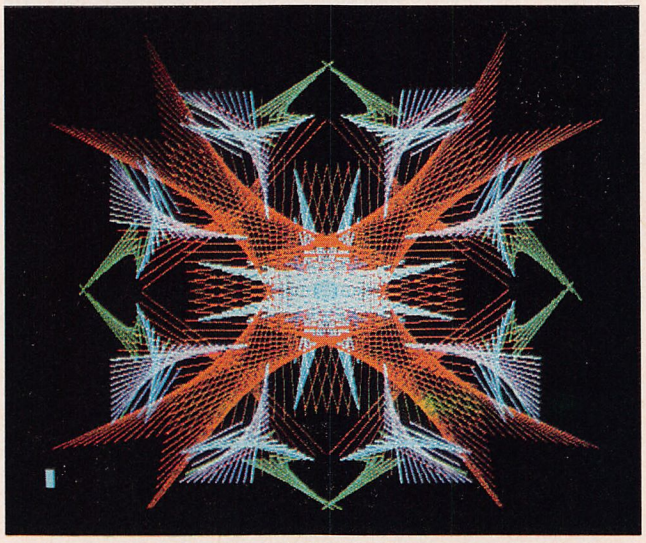
Disk Drives

TI offers several disk-drive configurations. Standard with the basic machine is one 320K-byte double-sided, double-density floppy-disk drive, and there's room for a second floppy-disk drive to be added inside the system unit. In addition, buyers have the option of installing either a 5-megabyte or, by early fall, a 10-megabyte Winchester hard-disk drive.

Although its disk format is essentially identical to IBM's (data files from one machine can be loaded on the other), TI has chosen not to store data on the disk sectors in sequence on each track. Instead, the TI drive controller alternates sectors, storing information to

Disk access is reported to be statistically faster overall than on the IBM PC.

every other one in turn as the disk rotates. The extra time that it takes for the disks to be read allows the 8088 to preprocess data before storing it in memory. When no preprocessing is necessary, loading data from a TI disk can take up to twice as long as from IBM's. But Texas Instruments engineers believe that the Professional is eight times faster with preprocessing and that their method leads to statistically quicker disk access times overall.



A preprogrammed demonstration of the Professional's graphics.

As a nice touch, the floppy-disk-drive controller's circuitry is wired on the motherboard to handle four drives. This means that no extra cards need to be purchased or inserted into the option slots. The Winchesters do require a plug-in controller board, which will operate two hard disks.

The Professional's Printer

TI's Data Systems Group is offering a new dot-matrix printer, the Omni 800 Model 850, available with friction feed or tractor feed. It is a quick unit, capable of printing 150 characters per second (IBM's new Graphics printer prints 80 cps) in 24 different modes—enhanced, emphasized, compressed, and expanded, just to name a few. The printer's integral character generator produces eight distinct type fonts. The 850 can accept both parallel and serial input from 200 to 9600 bits per second. Most of these features are selected by setting eight small switches beneath the print head. The various parameters are easily set by raising a hinged cover and using a pencil point (when the power is off, of course).

In practice the printer works very well. Form feeds—which take a full ten seconds on the IBM—are done in just three on the 850. The platen can handle continuous and single-sheet forms up to 10 inches wide, sufficient for most reports and manuscripts. While not exactly quiet (no dot-matrix printer is), the 850 seems less harsh to the ears than comparable Epson printers. And the price is definitely reasonable: $599 for the basic friction-feed model, $659 for the tractor-feed model.

Speech, Other Options

A wealth of options is now (or will soon be) on the market for the Texas Instruments Professional Computer. Foremost among these is the versatile speech-recognition board.

This is probably the most sensational option TI is offering. Like the CRT controller card, the speech board is actually two cards that occupy only one slot. One sends and receives analog telephone signals, and the other handles high-speed signal processing using a new TI 32-bit microprocessor called the TMS320. With the appropriate program loaded into its 16K bytes of RAM, the board will accept voice input from a variety of sources, sample this input 8000 times a second, and finally convert these samples into a compressed, symbolic representation of speech using a technique called linear predictive coding. This code can be used to regenerate the speech signal as well, and with remarkable fidelity. In fact, different voices can be recognized—the reproduction is like that of a good connection on a long-distance telephone call.

Several different methods for entering speech are possible. The board has jacks for a microphone, a telephone, and a lightweight headset with both earphone and microphone. In addition, the board can direct output to the internal speaker, to external speakers, or to a telephone.

Other options include the following:

- **Modems:** Both 300- and 300/1200-bit-per-second modem boards are available. Each connects directly to the phone line without acoustic cups, and a normal handset can be plugged into a socket on the modem to allow voice conversations when data isn't being transferred.
- **Clock/analog card:** TI plans to introduce a real-time clock card powered continuously by a five-year battery. It will also accept input from analog devices such as joysticks and light pens.
- **Terminal emulation:** Because so many office micro-

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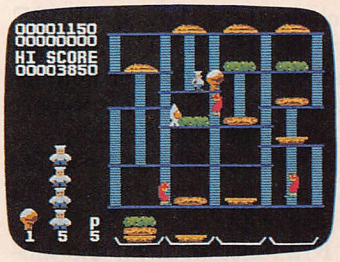
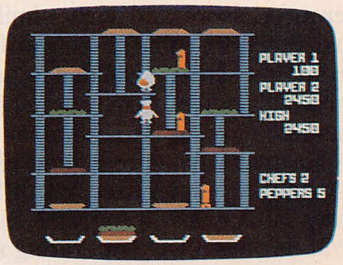


IBM® Personal Computer



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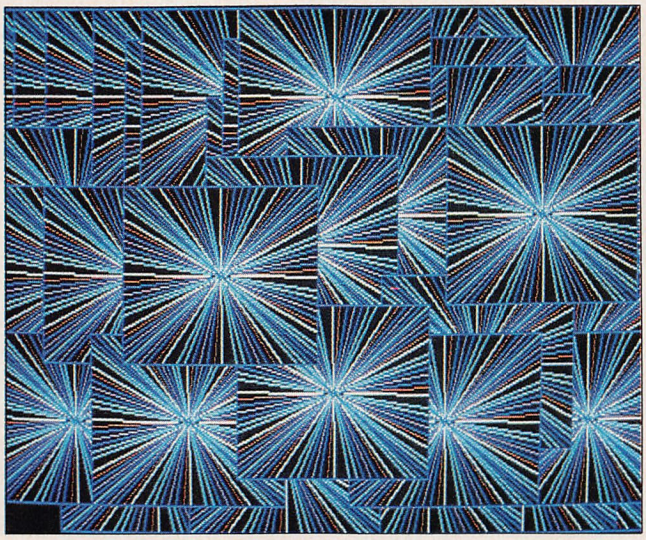
Circle 66 on inquiry card.

While the IBM PC and the TI Professional use Intel 8088s, there are some notable differences.



Several of the Professional's eight basic colors make up this design.

computers will eventually be linked to existing company mainframes, the ability to emulate a given terminal has become more and more important. With the right software, the Professional can disguise itself as an IBM 3270, 3780, or 3101 and hook into an existing computer network. In addition, a TTY (Teletype) communications program works with the modems for telecommunications.

- **Synchronous/asynchronous card:** This provides a serial RS-232C port for connecting a printer, another computer, or other serial peripherals.
- **Xedex Baby Tex:** Like the Baby Blue board for the IBM PC, this board comes with a Z80 microprocessor and allows the Professional to run much of the existing CP/M-80 software on the market.

Compatibility with IBM Software

As is usual with IBM competitors, software compatibility is a much-sought but elusive creature. While the IBM PC and the TI Professional have identical microprocessors and very similar input/output hardware, there are some notable differences—especially regarding on-screen text display and graphics. Because operating systems take charge of "housekeeping" functions like passing data between a user's program and the hardware, they are generally the only thing that needs to be customized on different machines. This allows inexpensive programs that run under, say, the CP/M-86 or MS-DOS operating systems on the IBM to run unaltered under the same operating system on the TI as well. Most software from distributors like Lifeboat Associates falls into this category.

Some more advanced programs, however, have a few of their own special input/output routines that bypass parts of the operating system to increase speed. Multiplan and Visicalc are good examples. Because they are partially customized, they cannot simply be transferred from one machine to another. In addition, some programs do not need a separate operating system at all to function—many games and of course the operating systems themselves are in this group. Loading these disks requires simple but proprietary boot-up routines supplied in ROM by the manufacturer. Once loaded, such software supplies *all* the necessary housekeeping functions. In the cases of Multiplan and Visicalc, TI has arranged for compatible versions.

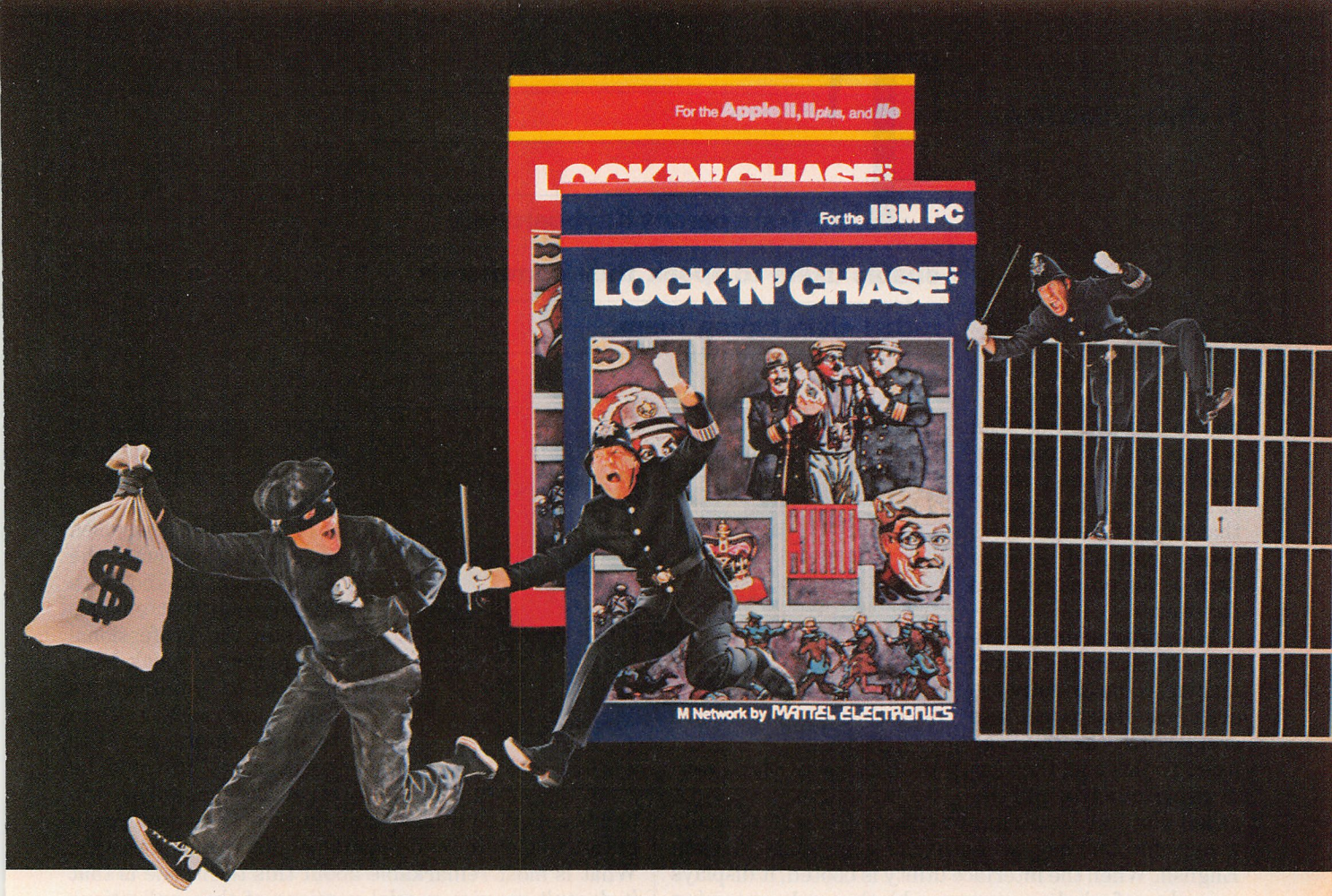
What about programming languages? Because the language systems being offered on the IBM and the TI are almost all the same, programs written in those languages should be transferable from one to the other without alteration. A caveat is in order concerning Microsoft BASIC, however: the TI version boasts additional graphics commands that the IBM would fail to recognize.

Available Software

Everyone in the computer business seems to have learned the same lesson: software availability supports hardware sales. Texas Instruments has not failed to heed this. TI had already arranged for over a hundred packages to run on the Professional Computer at the time of its announcement. Four of the major operating systems—MS-DOS, CP/M-86, Concurrent CP/M-86, and the UCSD p-System—can be used, and a partial roster of applications software includes 1-2-3 (Lotus), dBASE II (Ashton-Tate), Easywriter II (IUS), Multiplan (Microsoft), Visi On, Visicalc, Visifile, and others (Visicorp), Wordstar (Micropro), PFS:File, PFS:Report (Software Publishing Co.), and Supercalc (Sorcim).

Not all software packages from outside vendors have been updated to take full advantage of the Professional Computer's capabilities; Easywriter II, for instance, doesn't exploit the F11 or F12 function keys, and MS-DOS is version 1.25, essentially equivalent to IBM's version 1.10 rather than the newer version 2.0, which should be available by the end of this year.

In addition to third-party software, TI is marketing its own packages developed in-house. Its TTY communications package is one of the more sophisticated ones



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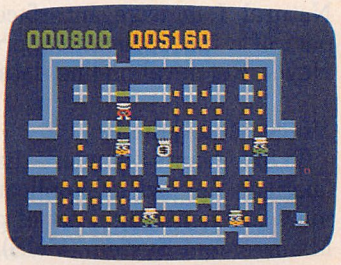

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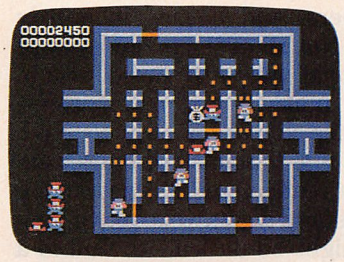

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The Transparent Keyboard will enable users to speak their commands rather than typing them.

on the market: users can set up their communications protocols on a series of screens and can specify that the function keys send command strings such as log-on names and passwords.

TI's programmers are also addressing the task of making complex software such as databases less cryptic to the average user. To this end, they are devising a set of utilities called Natural Language Interfaces that are basically menus for building sentence-like commands in plain English. When the interface utility is booted, it displays a number of windows or screen blocks, each containing a list of options—nouns, verbs, short phrases, and so forth. When combined, single entries from each window form a straightforward "conversational" question or instruction.

The TI 850 printer offers a wide range of features.

A sample question for a financial database might be, "What / is the price-volume ratio / concerning the company / IBM / for the last 13-24 days ?" Or, for a payroll system, "Find the / employee number / of / workers / whose birthdate is / ---." When executed, each component of the sentence is converted into the appropriate command in the database's query language. By the time you read this, the first implementation of the Natural Language Interfaces should be available as part of a full applications program for the Dow Jones News/ Retrieval on-line database.

Voice Managment

TI also wants to ensure that its speech board doesn't languish for lack of applications. Company programmers are polishing a set of programs called the Voice Management System (VMS), which combines routines for telephone dialing and answering, voice recording, and speech recognition. Among its numerous capabilities, this system can store a message from the user, automatically dial a series of telephone numbers, relay the message to each one, and record individual replies for later review. The recording feature can also be used to store one or more dictation sessions made through a microphone or telephone handset. It can save several different greetings for the automatic telephone-answering routine and "enroll" words and phrases against which instructions spoken into a microphone will be compared.

This last feature is used in conjunction with the Transparent Keyboard, a TI program that enables users of the Professional Computer to speak commands to applications programs rather than typing them on the keyboard. This could be especially helpful to the handicapped or to assembly-line workers using computers to monitor and record manufacturing statistics. What is most remarkable about this technique is that it doesn't require special versions of the applications programs. Instead, the Transparent Keyboard routines determine whether the words that have been spoken match previously enrolled templates or coded speech patterns and, if a match is found, send the appropriate keyboard codes to the application just as though the keyboard itself had been used. If no match is found, nothing happens.

None of this is simple, of course, and TI officials are reluctant to say firmly when VMS and the Transparent Keyboard programs will be available. They suggest that VMS will be sold along with the speech board itself, to appear sometime this fall.

Adequate Documentation

When IBM introduced its PC in 1981, it established a new standard for the quality and appearance of documentation for the entire industry. Now most everyone provides manuals printed in two colors, bound in three-ring binders, and housed in sturdy boxes. TI is no exception. Not all of the manuals were ready when the Professional was introduced, but in general those that were finished had been professionally typeset and printed and were easy to read. Care was taken not to assume too much computer expertise on the part of the reader, and all instructive passages were written to stand alone, without relying on earlier sections that might be difficult to find in a pinch.

In a couple of instances, however, the speed with which TI moved to make the documents available caused curious typos: pages repeated back to back, in-

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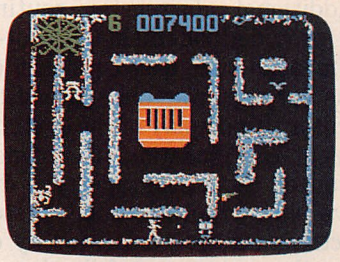
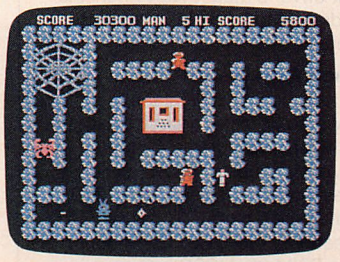
After all, what could be more fun than being trapped in a cave full of bats? How about being trapped in a maze as well. Underground.



Apple® II, II Plus, and IIe



IBM® Personal Computer

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Texas Instruments estimates mean time between failures at 5000 hours—roughly 2½ years of continuous use.

consistent examples, and the like. One surprising omission occurs in the MS-DOS manual. Apparently two separate manuals were originally planned but were combined along the way. Still, the overall quality of the manuals is very high, and they should serve most users quite well.

Diagnostics and Service

Inside and out, the Professional gives the appearance of being a reliable and durable machine. The material used to house all the components is solid and unyielding, most notably on the keyboard. Plug-in cards are supported by metal brackets and have plastic rests on top to buffer them from the system unit's cover. All connecting cables are heavy-duty. According to TI, the user could remove any part of the system with a screwdriver.

Several levels of diagnostics are provided to aid the user in tracking down faults. On powering up the system, a series of basic self-tests is performed before the disk drives come on; these check memory, controller circuitry, keyboard, and so on. Errors are indicated not just on the monitor screen but also by three small LEDs behind corresponding slots on the left side of the system unit. The LEDs stay lit in a given sequence (eight are possible) if something is wrong. This ensures that a system failure in the monitor or CRT circuitry will not prevent an accurate diagnosis.

Additional diagnostic routines are provided on disk. A boot-up menu asks the user to select options varying from ones to test the monitor to a display of the system's current configuration. Even more advanced tests examining the disk drive and other detailed system functions can be performed by exiting the menu and following instructions in the technical manual.

TI has arranged for several types of service, should it be required, both during the initial 90-day warranty period and later under one of several optional maintenance agreements. Depots have been set up in 25 major metropolitan areas where computers can be dropped off for repair. On-site service is available at a slightly higher cost, and special arrangements can be made for offices or commercial locations with more than one machine. Texas Instruments doesn't anticipate many problems, however; its estimated mean time between failures for the Professional is 5000 hours—roughly 2½ years of continuous use.

It appears suspiciously as though all the work that went into the Professional Computer could be enough for several machines, and TI may well have more ambitious plans. The keyboard, for instance, has large blank areas that seem destined to accommodate more keys in another incarnation—perhaps in a larger Motorola 68000-based computer that TI is rumored to be developing. Company officials don't hesitate to admit that Texas Instruments wants to be a major force in the professional and small-business computer market in the future. Taking on such well-established names as IBM and Apple certainly shows that the company has high expectations and lots of confidence. If the Professional Computer is an indication of the kind of machines the company plans to introduce in the future, TI will be a major force in the personal computer marketplace. □

At a Glance

Name: Texas Instruments Professional Computer

Manufacturer
Texas Instruments Inc.
Data Systems Group
POB 402430, H-642
Dallas, TX 75240
(512) 250-7305

Uses
Personal computing in offices, professional firms, small businesses, scientific institutions, and homes

Standard Features
Intel 8088 microprocessor, 64K bytes of RAM, 8K bytes of ROM, 6 expansion slots, 97-key detached keyboard, 320K-byte double-sided, double-density floppy-disk drive with built-in controller, 12-inch monochrome or 13-inch RGB color monitor, parallel printer port, fan, speaker, self-test diagnostics in ROM, diagnostics disk

Base List Price
$2595 with 12-inch monochrome display and controller card

Typical System Prices
$5490 with 256K bytes of RAM, 12-inch monochrome display and controller card, 320K-byte floppy-disk drive, 5-megabyte Winchester hard-disk drive
$6875 with 256K bytes of RAM, 13-inch RGB monitor and controller, 320K-byte floppy-disk drive, 5-megabyte Winchester hard-disk drive, Model 850 printer with tractor feed

Options and Accessories
Hardware: 300-bps or 300/1200-bps modem, two color raster-graphics cards, 320K-byte floppy-disk drives, 5- or 10-megabyte Winchester drives, synchronous/asynchronous serial card, Z80 CP/M card, speech board; Software: TTY Communications, MS-DOS, CP/M-86, Concurrent CP/M-86, UCSD p-System, CP/M-80 (with plug-in Z80 card), and most major software packages compatible with IBM PC; Languages: MS-BASIC, COBOL, FORTRAN, Pascal

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Meet the Personal Information Terminal. With just a simple connection to your existing phone lines, Scanset XL gives you immediate access to computerized information sources like Dow Jones, and even UPI.* In all, over 1200 available data banks have answers on everything from gold futures to gold records.

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Scanset XL gets you instant answers to the questions raised in a normal business day. Questions that normally take a full business day to answer.

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POPULAR REVIEWS:

A state-of-the-art portable for the mobile professional

THE MOBILE COMPUTER

GAVILAN

by Dennis Allen

During my travels to computer shows I spend a great deal of my time on an airplane and in a hotel room scribbling on a notepad. I miss my word processor, and I picture it sitting idle on my desk—hundreds of miles away. If only it were portable, I find myself thinking.

I'm not alone. Many professionals, while away from the office, need immediate access to the words and numbers that keep their businesses running. These people are the mobile professionals, and their responsibilities often require them to divide their time among different cities, states, or countries. Although computers that provide and manipulate important data may be available in their home office, mobile professionals have long been faced with the you-can't-take-it-with-you problem.

The computer industry, however, has not completely ignored the needs of the mobile professional. Adam Osborne led the way with the Osborne 1, which he sold (and still sells) complete with applications software for $1795. Then, a myriad of other companies followed suit, offering a variety of features or refinements. Later, Grid Systems introduced the Compass, a portable computer that uses bubble memory and a relatively new, electroluminescent flat display, two features that require much less power and smaller battery packs than conventional portable systems. But you pay for that advantage—a Grid system with disk drive and applications software sells for $13,000.

Most of the other portable computers have major drawbacks: they're either bulky or dependent on an outside power source. Sure, a computer that folds up into its own case can go along for the ride but if a so-called portable computer is dependent on an outside power source, it can be considered as nothing more than transportable, or should I say "luggable."

Gavilan to the Rescue

Gavilan Computer Corporation overcame those obstacles with the Gavilan. The $3995 16-bit computer fits into a briefcase—even when its own full-page printer is attached—operates for up to eight hours on its rechargeable batteries, and has a built-in 3-inch microfloppy disk drive.

The Gavilan Computer Corporation was formed in February 1982 and its first computer, the Gavilan, was unveiled at the Comdex show last spring.

Gavilan's president and chief executive officer is Manny A. Fernandez, formerly the chief executive officer of Zilog Inc. During his tenure at Zilog, Fernandez created a name for himself in the computer industry, thereby acquiring the necessary backing to start the new company.

Speaking like a first-time father, Fernandez claims to have brought together "some of the brightest minds in the microcomputer industry" to form the new company. The Gavilan computer is evidence to support Fernandez's claim. The new machine leaves behind the me-too technology that recently seems to have gripped the market.

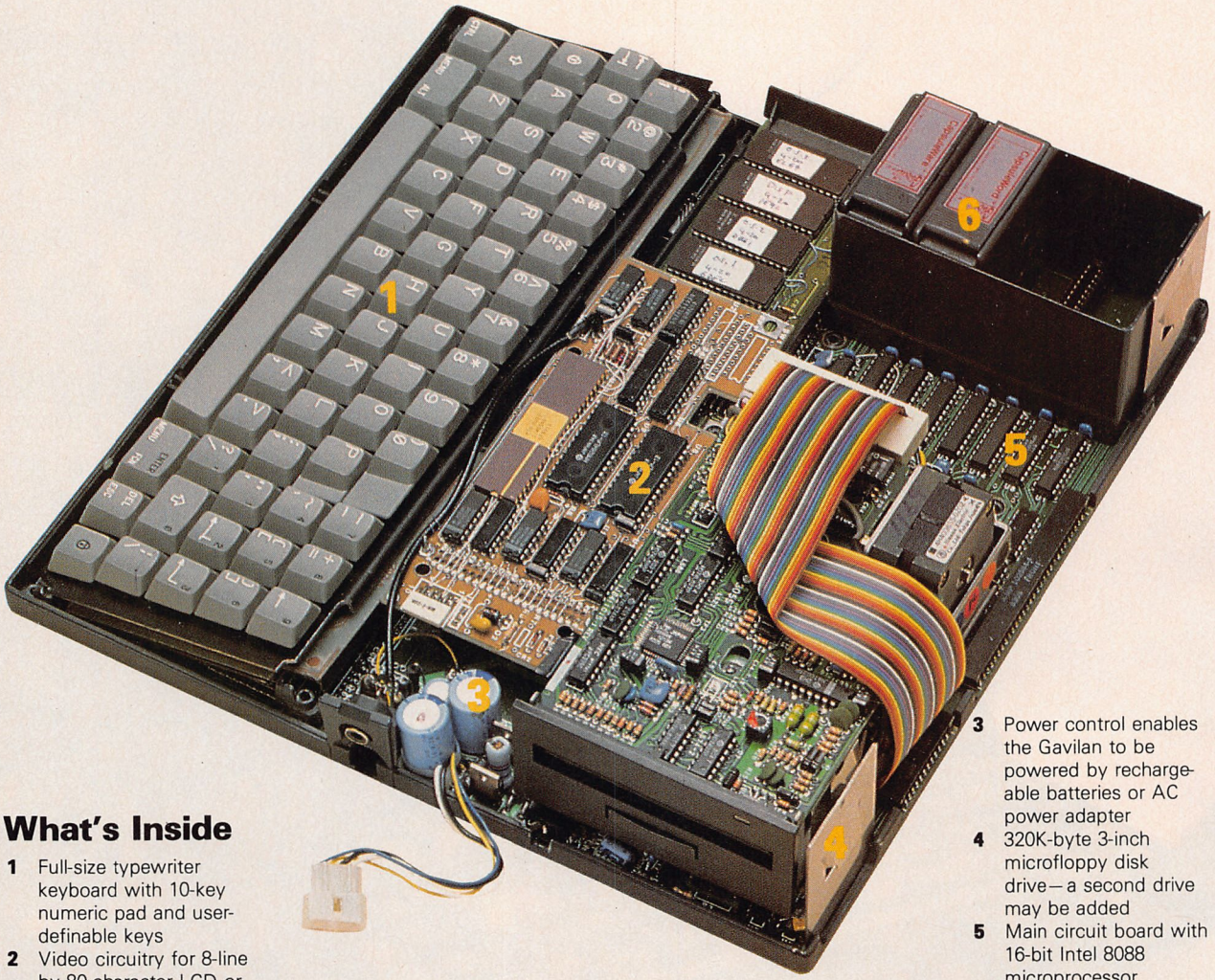
Portability has been the goal of many computer designers, but power-supply problems have been dif-

Dennis Allen is a technical editor of *Popular Computing.*

Photographs by Jack Freed

to like
TWA.

Designing a computer that fits in a briefcase is not an easy engineering task. As you can see here, all the Gavilan's circuit boards are compact so that no space is wasted. Any number or combination of as many as four 32K-byte capsules can be plugged into the computer for added memory or programming. Original plans for the Gavilan included a 3-inch microfloppy drive like the one used in the prototype shown here. However, demand dictated a change to the more readily available 3½-inch Shugart drive for all Gavilan production models.



What's Inside

1. Full-size typewriter keyboard with 10-key numeric pad and user-definable keys
2. Video circuitry for 8-line by 80-character LCD or optional 24-line by 80-character video monitor
3. Power control enables the Gavilan to be powered by rechargeable batteries or AC power adapter
4. 320K-byte 3-inch microfloppy disk drive—a second drive may be added
5. Main circuit board with 16-bit Intel 8088 microprocessor
6. Two 32K-byte microcircuit capsules—as many as four may be added

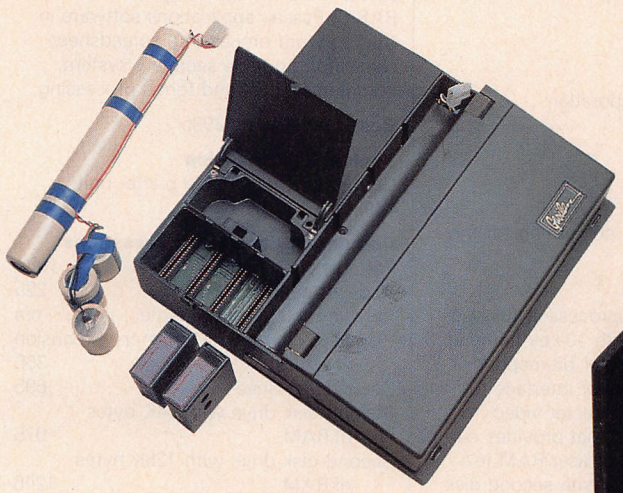
ficult to overcome. Only recently have technological advances in microcircuits that use comparatively little power (called CMOS—complementary metal-oxide semiconductor—technology) offered freedom from gigantic battery supplies or outside power sources.

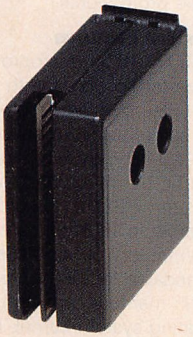
The Gavilan takes advantage of the energy-efficient CMOS technology and offers true portability. Its size (less than 3 inches thick and 11.4 inches square) allows the complete system to fit inside a typical briefcase, and at 9 pounds it is light enough to carry easily. If size were its only virtue, however, the Gavilan would have little impact in the market because Radio Shack and Epson offer even smaller portables. But the Gavilan has more going for it than just its size.

The Gavilan's internal battery powers the Intel 8088 16-bit microprocessor and a built-in disk drive. And its advanced "human interface" and state-of-the-art design clearly earn the Gavilan the right to be heralded as a "breakthrough."

A Closer Look

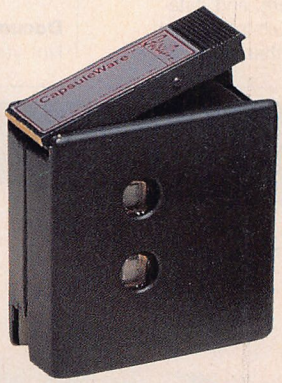
The Gavilan's top-front section, which houses the liquid-crystal display (LCD) screen, opens to expose a full-size typewriter keyboard that includes a 10-key numeric pad. Ten touch-sensitive switches, located just above the keyboard and below the LCD, operate

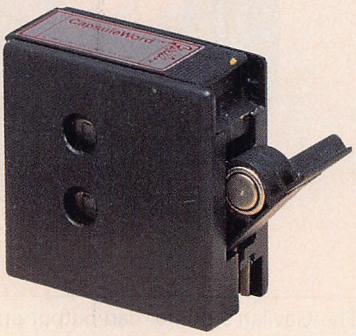


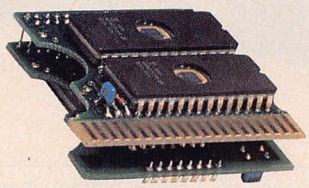


Power and Memory

Internal rechargeable batteries (above) power the Gavilan, its built-in disk drive, and memory capsules for up to eight hours. The Gavilan's applications software is stored in the 32K-byte microcircuit capsules (right and below). Capsules containing RAM only are available, and each comes with its own lithium battery to retain data stored in the capsule when it is removed from the computer. You can add or remove capsules as needed without technical assistance.







as user-definable keys, which are necessary for many application programs. The keyboard and display are completely hidden when the computer is closed and ready for travel. The touch switches, when not defined by program control, interact with the human-interface software and offer the following commands: Help, Cancel, Extend, Select, Menu, Scroll, Scroll Again, View, and Scroll Back.

The individual touch switches surround a larger touch pad that provides cursor control. The bit-mapped, 8-line by 80-character display is one of the largest you'll find on a portable. The screen can display bold or italic characters in a line of regular text as opposed to displaying printer codes, as is common with word processors. A contrast adjustment helps compensate for glare.

Horizontal and vertical scrolling make viewing large documents easy. The video driver can control a desktop-size 24-line by 80-character video monitor, the size needed for most commercial word processors.

A combination AC adapter and battery-pack charger is included with the Gavilan and will plug into a standard 110-volt outlet. An optional set of world-wide adapter plugs is available for European 220-volt outlets. The charger provides either a fast charge or a trickle charge. A fast charge takes about an hour if the Gavilan is not in use. You can operate the Gavilan while using the trickle charge, but it takes several hours for a full charge. In practical terms, the eight hours of computing time provided by the batteries is ample for a full day's work.

The Human Interface

The general consensus in the computer industry is that computers must do what they do invisibly. In other words, you should not have to memorize a long list of different commands just to begin editing a business letter.

How is this accomplished? Many believe the best way is to use a combination of special hardware and software that's designed to interact easily with the user and that requires little or no training, such as that found in Apple's Lisa (reviewed in March 1983). The Lisa is a complete electronic desktop with a mouse cursor-positioning device. You can select menu items on the video monitor by moving the mouse about on a desktop.

Instead of a mouse, the Gavilan uses a solid-state touch pad to change the cursor position. When you move your finger across the touch pad, the cursor on the display screen moves accordingly. In addition, the Gavilan incorporates a sophisticated human-interface system for ease of use. Here's how it works:

First, you plug in up to four memory modules, called capsules, each of which contains an application program. Because the programs stored on the microcircuits inside the capsules connect directly to the circuitry, you have instant access to any program.

Next, you touch the View switch. Immediately, the display shows an electronic desktop with icons (graphic representations) of files, documents, and programs available. The display indicates the level of each file with a graphic representation. For example, a third-level file might be a letter that is inside a client's file folder, which is inside a file drawer containing other clients' folders. To select any of the files or options, you move the cursor, or pointer, on the screen by moving your finger across the touch pad. As the pointer moves, each item it passes is highlighted. When the item you want is highlighted, you tap your finger once on the touch pad, and the selection is complete. If you get lost, you can call for help any time by touching the Help switch. The computer will display a menu of four questions: "What just happened?" "Where am I?" "What is this I am seeing?" and "What do I do next?"

If you move the pointer to any of the questions, again using the touch panel, and tap the panel, the computer will answer that question. For example, a response to the question "What just happened?" would be, "You are viewing your desktop. You are pointing to a file drawer which is now highlighted. Nothing else has happened."

As you continue to use the computer, the answers will change accordingly. In other words, the Help function keeps track of where you are in a program at all times. This function lets a new user operate the Gavilan in a short time with little instruction, and it's like having a built-in user's manual.

At a Glance

Name: Gavilan

Manufacturer
Gavilan Computer Corporation
POB 5004
Campbell, CA 95008
(800) 528-6050

Uses
Personal and business computing for the mobile professional

Standard Features
Intel 8088 16-bit microprocessor; full-size typewriter keyboard with 10-key numeric pad; 8-line by 80-character bit-mapped LCD screen; video-monitor interface to drive a 24-line by 80-character video monitor; flat touch pad that provides cursor control; 32K bytes of user RAM (expandable to 160K bytes with second disk drive/memory option); 48K bytes of ROM (expandable to 208K bytes with four plug-in memory capsules) including operating system kernel, interpreter, human-interface software, and data-structuring software; built-in 3½-inch microfloppy disk drive that stores 320K bytes; MS-DOS operating system; BASIC; Pascal; applications software including word processing, spreadsheet calculator, portable secretary system, communications, and forms processing

Base List Price: $3995

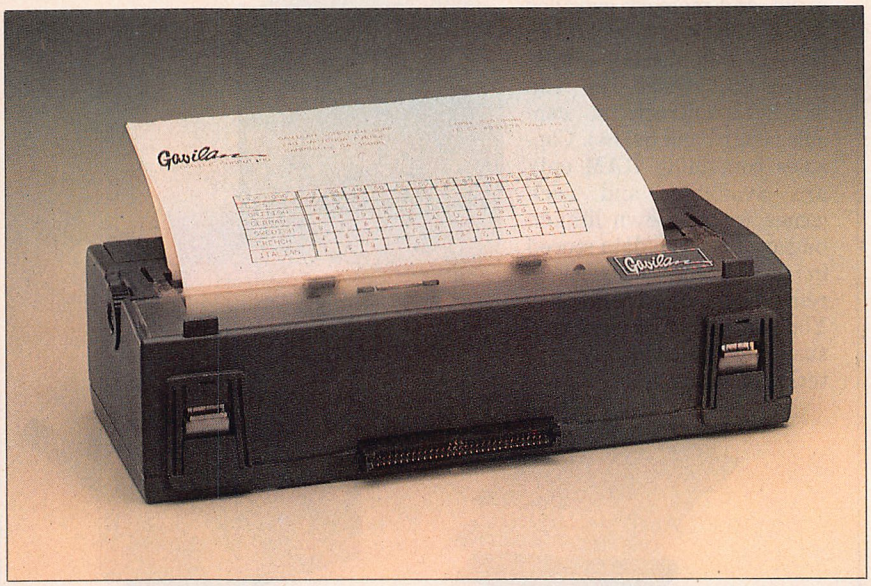
Typical System Price
Computer and portable printer unit, $4980

Popular Options and Accessories

Portable printer unit	$985
Acoustic coupler/modem	225
Vehicle lighter power adapter	n/a
Plug-in 32K-byte RAM memory expansion capsules	350
Second disk drive	695
Second disk drive with 64K bytes of RAM	975
Second disk drive with 128K bytes of RAM	1245
Second recharge/adapter	150
World-wide adapter plugs	45

Other Languages Available
None

Documentation
Not yet available



The Gavilan's printer can output up to 30 pages on a single battery charge.

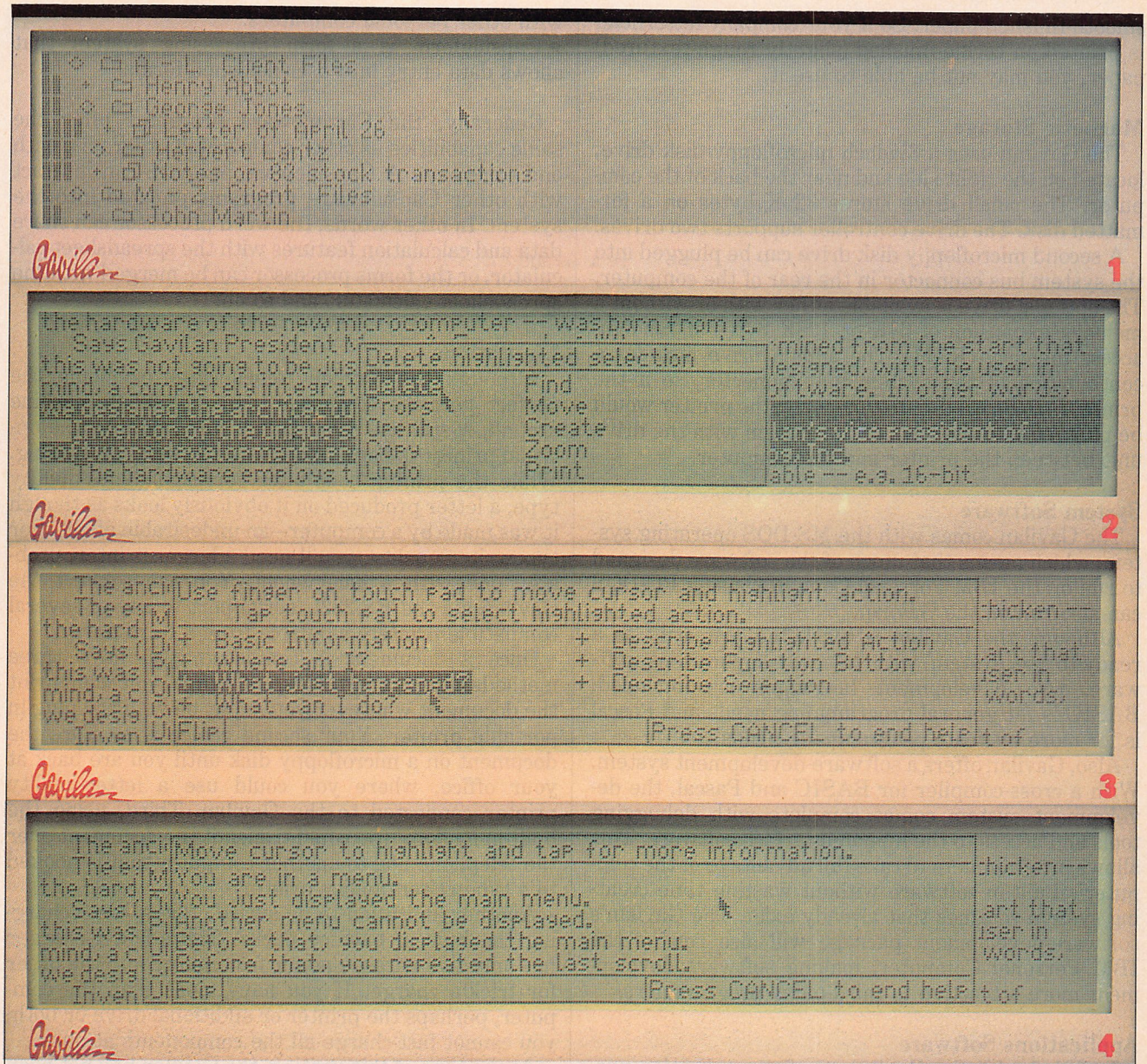
Another feature of the human interface is the use of menus. Pressing the Menu touch switch will get you a list of options on the LCD screen, and you can select any of the options with the touch panel. One option used in the word-processing software is called Zoom. This command will display a miniature graphic representation of an entire page, thus giving you an idea of how the printed page will look. The miniature display also draws a thin border around the eight lines of the document you're presently working on to let you know where you are in the document. Moving the border to another section of the miniature page followed by a tap on the touch pad displays the corresponding text.

The Mechanical Interface

An RS-232C serial interface that operates at a speed of up to 9600 bits per second (bps) is built in. The RS-232C provides easy access to many peripheral devices including high-speed letter-quality printers.

Telephone communications are made easy with a built-in auto-dial modem. The modem connects directly to a modular telephone line, operates at 300 bps, and uses the communications software Capsulecomm, included with the system.

A video-monitor interface, also built in, allows you to connect to a video monitor. But, unlike some other computers, the Gavilan does not merely send the



Touching the View switch causes the display to show an electronic desktop (1) with icons of files and documents. Using the touch pad, you can move the pointer to a specific file and tap once to open that file. Once a file is opened, a block of text can be marked and highlighted with reverse video (2). Touching the Menu switch causes a menu of options to overlay the text. Whenever you are confused, touch the Help switch to display the help menu (3). By using the touch pad to move the pointer, you can have any question answered (4).

monitor the same signal it sends to the built-in LCD screen. Instead, it sends a full-size, 24-line by 80-character screen.

For further expansion, a system bus connector in the rear of the computer will support a portable printer or a second disk drive.

The Five-Pound Printer

The optional 5-pound Gavilan printer, $985, plugs directly into the back of the computer. With the printer in place, the system looks like a single unit. The printer has its own self-contained battery pack which supplies enough power for printing up to 60,000 characters, or about 30 pages, per charge.

The printer delivers 50 dot-matrix characters per second and uses a standard pitch of 10 characters per inch. It can produce bold, italic, underline, superscript, and subscript. Right-margin justification is available using the word-processing program, Capsuleword.

The printer will accept regular typing paper or any single-sheet paper up to 8½ inches wide. The print mechanism uses a special thermal ribbon and does not allow the use of multipart forms, but duplicate originals can be easily produced with the word-processing software.

One word of caution: the print mechanism requires

smooth-finished paper. So if your company letterhead is printed on cockle-finished (slightly rough-textured) paper, you may not be able to use it.

Magnetic Storage

The Gavilan uses a 3½-inch microfloppy disk drive, located on the right side and near the back of the computer. The small drive stores 320K bytes on a formatted disk. The drive controller supports two drives.

A second microfloppy disk drive can be plugged into the system bus connector in the rear of the computer. The optional drive is available either with or without a memory expansion of 64K or 128K bytes of random-access memory (RAM). The add-on drive includes a continuation of the system bus connector, so if the printer is to be used simultaneously, the printer would be plugged into the back of the system with the drive unit between the printer and the computer.

System Software

The Gavilan comes with the MS-DOS operating system, which means that much of the software designed to run on the IBM Personal Computer using PC-DOS can also run on the Gavilan.

Although the Gavilan is marketed primarily as a ready-to-use system with its own applications software, two development languages are included: BASIC is for general programming needs and Pascal is for more intricate programming needs.

Also, Gavilan offers a software-development system. With a cross-compiler for BASIC and Pascal, the development system comes complete with debugging tools and access to the human-interface software. This allows programmers to take full advantage of the computer's built-in software without wasting time creating system routines that already exist. The Gavilan's software-development package will also run on the IBM Personal Computer, making software development more attractive to third-party programmers.

Applications Software

Included with the Gavilan are five application programs that are stored in the microcircuit capsules—hence, the name Capsuleware. All the Capsuleware programs—word processing, spreadsheet calculator, communications, forms processing, and the portable secretary—were developed by Gavilan and are not clones of other popular programs. Here is a brief description of each:

- Capsuleword is a full-feature word-processing system that allows documents to be stored on disk.
- Capsulecalc is a spreadsheet calculator system with the ability to exchange data with Capsuleword.
- Capsuleoffice is a portable secretary system that keeps track of schedules and appointments and provides a tickler file and activity reports.
- Capsulecomm is a communications system that provides access to private or commercial databases (such as Compuserve or Dow Jones) and for communications with other personal computers.
- Capsuleform is a forms-processing system that allows data entry into user-designed forms.

Generally, the Capsuleware programs offer the same capabilities as other comparable programs, with one exception. A Capsuleware program can interact with other Capsuleware programs plugged into the system. In other words, the word processor can share data and calculation features with the spreadsheet calculator, or the forms processor can be merged with the spreadsheet calculator, and so on.

Limitations

Although the Gavilan comes closer to being the perfect portable computer than any other machine around, it still has some faults. For example, the optional printer is barely adequate for word processing. While the printer does offer correspondence-quality type, a letter produced on it obviously looks as though it was made by a computer—an undesirable effect. For typewriter quality, you'll need a larger printer, probably one with a daisywheel. You can connect the Gavilan via the RS-232C serial port to any of several compatible printers available from a third party.

Once a document is composed, you have three methods of printing it. First, of course, you could print the document wherever you might be with the plug-in portable printer. Your second choice is to store the document on a microfloppy disk until you are back at your office, where you could use a letter-quality printer connected to the Gavilan. Third, using the built-in modem, you could transmit the document over the telephone line to another computer that is hooked to a typewriter-quality printer.

Another limitation to be aware of involves recharging the built-in battery packs. The adapter-charger has only two wires—one for fast charge and the other for trickle charge. If you have more than the computer, perhaps the printer or additional drive or both, you cannot fast-charge all the components at once.

At the time of this writing, the Gavilan had not been released for distribution, and the manufacturer was working on the recharging problem. One way around the dilemma might be to buy a second charger.

Who Should Buy the Gavilan?

The Gavilan's 16-bit technology, memory capabilities, built-in microfloppy drive, and $3995 price tag make it worthy of consideration by anyone in the market for a 16-bit personal computer. Because those features are contained in a single, portable package—for less than half the price of its closest competitor, the Compass—the Gavilan is a practical solution to the computing problems encountered by on-the-move professionals.

The Gavilan combines the latest technological advances in portable computing with a couple of new twists while avoiding the me-too technology. It is, indeed, state of the art. □

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POPULAR REVIEWS: *An Apple-compatible computer that includes CP/M and much more*

BASIS 108

by Rob Moore

It's no secret that the Apple II, produced by Apple Computer Inc., has been one of the most successful computer products ever designed. With over 800,000 units installed and the world's largest library of software, it is a natural candidate for imitation, and a number of companies are producing Apple look-alikes. These imitations range from virtually exact copies made in Taiwan (deemed illegal and currently being embargoed and seized by U.S. Customs) to various American machines that imitate parts of the Apple II's design and somehow manage to provide Apple software. Some of these imitations are too close for comfort—Apple Computer is currently suing Franklin Computer Inc. for patent and copyright infringements. Others that apparently don't violate Apple Computer's legal rights are free to compete in the marketplace. Of these, the Basis 108 microcomputer is perhaps the most appealing, offering a number of stan-

Photograph by Bill Buckley

dard features that are available only at extra cost on the Apple II Plus or IIe.

More than just an Apple imitation, the Basis 108 is better described as an Apple-compatible machine. The company emphasizes the numerous advanced features of the 108 and its CP/M 3.0 operating system in hopes of attracting the advanced user who needs a fully expanded system capable of running Apple and CP/M software.

After the Basis 108 hit the market, Apple introduced its own improved model—the Apple IIe—and discontinued production of the Apple II Plus. With a few options added to its base price, the Apple IIe provides capabilities that are very similar to those of the Basis. Which machine is the better buy? Should you go for the tried and true brand name, or does the new kid on the block get your money? This article will help you decide by taking a close look at the Basis 108.

The Basis 108 is an Apple-compatible computer with a number of built-in features that are extra-cost options on the Apple IIe.

The Basis 108 is available in only one version, and while its $2995 price seems high, you do get a lot for your money. The computer comes with both 6502 and Z80 microprocessors, 128K bytes of random-access memory (RAM), two 5¼-inch floppy-disk drives, and built-in interfaces for serial and parallel input/output devices, cassette tape, or game controls. It can display text in either 40 or 80 columns and includes Apple II-compatible color graphics. The keyboard is a detached, low-profile unit offering 15 special function keys and separate keypads for cursor control and entry of numeric data. The CP/M 3.0 operating system comes with the Basis 108 and is modified to take advantage of the machine's special features. (If you don't need CP/M, you can leave it out and save $100.) Options include video displays, a 256K-byte RAM floppy-disk simulator, and the Perfect software series (Perfect Writer, Calc, Speller, and Filer) specially modified to employ the 108's particular capabilities. All of this is designed to lure the advanced user—the professional or businessperson who would have had to purchase a number of options to build an equivalent system around an Apple IIe.

The Hardware

The Basis 108 is manufactured in Germany by Basis GmbH and sold in this country by the U.S. subsidiary Basis Inc. Although it's a single-board computer, the 108 is enclosed in a rugged two-piece aluminum case somewhat reminiscent of the early S-100 computers. This large box, about 19 inches square, takes up a good deal of desk space, especially with the keyboard placed in front.

While the 108 doesn't come with a video display, it does include three video outputs—RGB, NTSC color, and NTSC monochrome gray scale—that allow you to use virtually any video monitor. If you're willing to limit yourself to the 40-column display mode, you could also use an RF (radio-frequency) modulator to display the 108's text and graphics on your TV set.

In addition to the video connectors, the rear panel provides rugged D-type connectors for the keyboard, serial and parallel interfaces, and two utility power outlets for your monitor and printer. The box also has openings for mounting additional D-connectors and a larger cutout that will accommodate a ribbon cable. The power switch is conveniently located at the front of the case along with the two built-in floppy-disk drives.

The main board holds all of the 108's circuitry except for the disk controller. This board provides six Apple-compatible input/output slots and an Apple-style game paddle socket. Unfortunately, the game socket is quite close to the power supply harness—it would be easy to bend or break a connector pin while trying to insert a plug in such a cramped space.

The only additional board in the machine is the Basis diagnostic disk controller, typically plugged into slot six. Besides controlling the disk drives, the disk controller performs a short diagnostic test when you turn the power on, and you can invoke a more comprehensive set of tests if you wish. Pressing M during the initial power-up test displays a diagnostic menu from which you can select tests of the text display, graphics, memory, or other parts of the system.

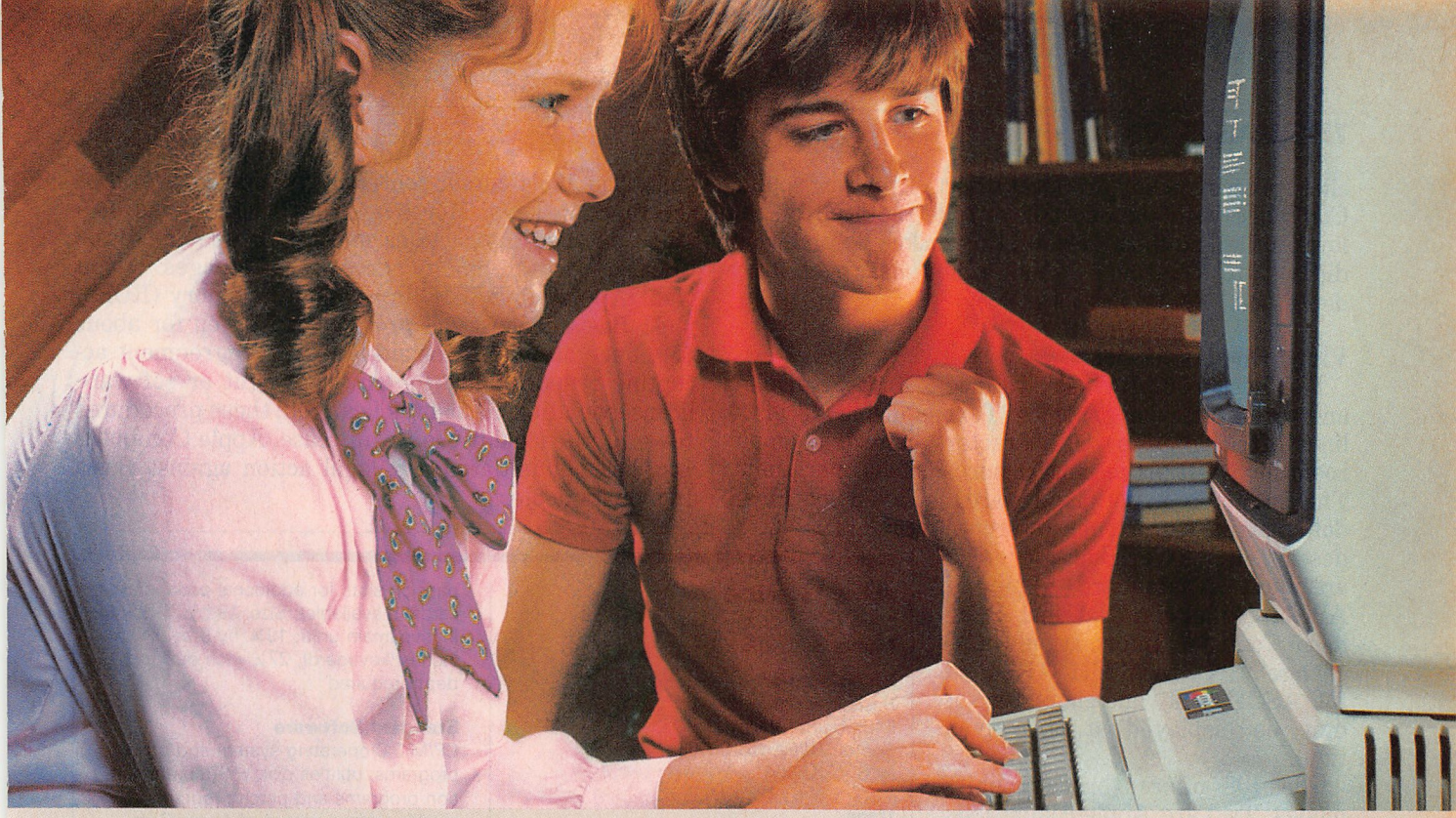
The Keyboard

The keyboard is one of the most impressive features of the Basis 108. Its 100 keys provide a 58-key typewriter array, a 9-key cursor-control pad, an 18-key numeric pad, and 15 function keys that can invoke as many as 60 special functions when used with the appropriate software. All keys repeat automatically after about six-tenths of a second, and you can engage either caps-lock or shift-lock mode using the lighted Lock key.

If you do much work with numbers, the numeric keypad will certainly be useful. In addition to the 10 digits and a decimal point, it includes the four standard arithmetic operations as well as keys for equals, return, and clear entry.

The keyboard does have some quirks, though. It has an unusual touch, and you must release each key before pressing the next one. Rather than an audible

Rob Moore is a design-engineering manager with a strong interest in FORTH, graphics, and computer music.



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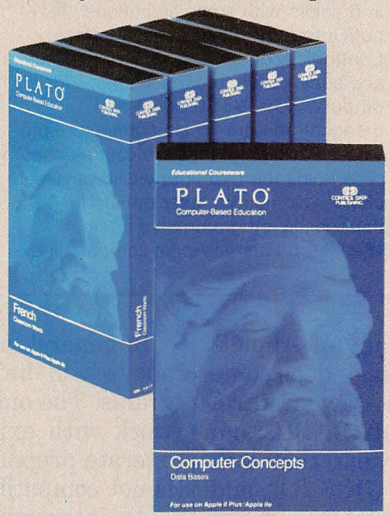

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click, pressing a key produces a sort of rubbing sound. Combined with the short keystroke required by the low-profile European design, this makes it somewhat difficult to determine when a key has been fully depressed.

Video Display Modes

The Basis 108 provides two modes for text display and three for color graphics. Text is displayed in 24 lines of either 40 or 80 characters, affording ample room for word processing or spreadsheet operations. The characters in both modes are displayed in a 7 by 8 dot matrix with true lowercase descenders. Five character sets are built in: standard Apple II, ASCII (American National Standard Code for Information Interchange), German ASCII, APL, and full ASCII. Only one character set may be displayed at any given time.

The 108 offers three graphics modes. Two are Apple-compatible: a low-resolution (40 by 48 pixels) mode with 16 colors and a high-resolution (280 by 192 pixels) mode with 6 colors. There is also a 16-color mode of medium resolution (80 by 48 pixels) that is not compatible with the Apple II. Interestingly, the 108's high-resolution colors do not perfectly match those on an Apple II or IIe. This shouldn't be a problem, but you might be taken aback the first time you play your favorite Apple arcade game on the Basis.

Apple Software Compatibility

How can Basis offer what is in effect Apple software without infringing on copyrights? This is an interesting question, especially given the illegality of software included with some cheap Apple imitations. It does seem that Basis has found a way around copyright restrictions, even if it is rather convoluted.

Basis Inc. does not *directly* supply any of Apple's software. However, the Basis 108 package does come with a disk called The Filer (produced by Central Point Software) that includes Applesoft BASIC and DOS 3.3. Basis also provides programs that will modify Applesoft or Integer BASIC, DOS 3.3, and Pascal 1.1 to take advantage of the special features of the 108. These modifications, which can be made by your Basis dealer, support the 108's upper- and lowercase 80-column display and built-in serial and parallel interfaces; the modified Pascal 1.1 additionally supports the 108's cursor-control keypad and several of the function keys. Moreover, the Basis manual provides detailed instructions on how to use the Basis "Booter" disk to modify the Apple languages. If you want Applesoft BASIC in read-only memory (ROM), most Basis dealers will program it for you for about $50, but you may be asked to sign an agreement accepting responsibility for any copyright or software license violations. As far as I can tell, these procedures cover all the legal bases. In any case, Apple Computer Inc. has not initiated any legal action against Basis Inc. or its dealers.

In general, a Basis 108 with the software described above will be compatible with most Apple II programs. The only difficulty is that programs written to work with existing Apple 80-column cards may not operate properly because the Basis 80-column display is not compatible with the Apple's.

An interesting software feature provided by Basis enables the 108 to use its extra 64K bytes of RAM as a "soft disk." This software, which works with Apple DOS 3.3, Pascal, or CP/M, lets you store data temporarily and access it with disk commands. This opera-

At a Glance

Name: Basis 108

Manufacturer
Basis Inc.
5435 Scotts Valley Dr.
Scotts Valley, CA 95066
(408) 438-5804

Uses
Personal computing for home and small-business applications

Standard Features
Keyboard: detached low-profile full ASCII keyboard with 58-key typewriter array, 9-key cursor-control pad, 18-key numeric pad, and 15 special function keys; Microprocessor and Memory: 6502 and Z80 microprocessors (to emulate an Apple II with Z80 card), 128K bytes of RAM, 2K-byte ROM monitor; Mass storage: two built-in Apple-compatible 5¼-inch floppy-disk drives storing 140K bytes each; Display: 24 lines of either 40 or 80 characters, three graphics modes (40 by 48 pixels in 16 colors, 80 by 48 pixels in 16 colors, and 280 by 192 pixels in 6 colors with some limitations); Input/Output: RS-232C serial interface, Centronics-compatible parallel interface, and audio-cassette connections; Video outputs: RGB, NTSC color, and monochrome gray scale connectors provided; Packaging: massive cast aluminum case holds the two floppy-disk drives, includes two utility power outlets for peripherals, programmable internal speaker, 6 internal Apple-compatible expansion slots for additional peripheral cards (5 available); Size: 19 by 7½ by 19 inches (main unit), 19¼ by 9 by 1¾ inches (keyboard), 27½-inch desktop depth required

Standard Software
CP/M 3.0 operating system and utility programs; utilities disk with demonstration programs and patch programs to modify various pieces of Apple Computer software; The Filer (from Century Point Software) containing Apple DOS 3.3 and Applesoft; Basis Booter disk with special disk-booting routines to allow use of Apple Visicalc and programs to modify Apple Computer's Applesoft, Integer BASIC, and Pascal 1.1 for use with the Basis 108; the Basis 108 will run most Apple II software without modifications

Base List Price
$2995

Typical System Price
$3270 for a system with a Basis green-screen video monitor and Applesoft in ROM (includes $50 to have your copy of Applesoft programmed into ROM)

Documentation
Instruction manual (not suited to beginners)

Options and Accessories
Hardware: game paddles, BASRAM 256K-byte RAM floppy-disk emulator, 12-inch green or amber monitor; Software: Perfect software series

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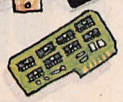

ACE Display card
Opens video display to a full 80 columns by 24 lines

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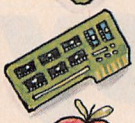


ACE Dual Interface card
Allows you to connect to local and remote printers, terminals, computers and other accessories

Apple II compatible

64K of RAM

Ulc Upper & lowercase

Typewriter-style keyboard

12-key numeric pad

VisiCalc keys

50-watt power supply

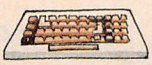
Built-in fan

1982

Apple II compatible

64K of RAM

Ulc Upper & lowercase



Typewriter-style keyboard

12-key numeric pad

VisiCalc keys

50-watt power supply

Built-in fan

1983

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SuperWriter.™

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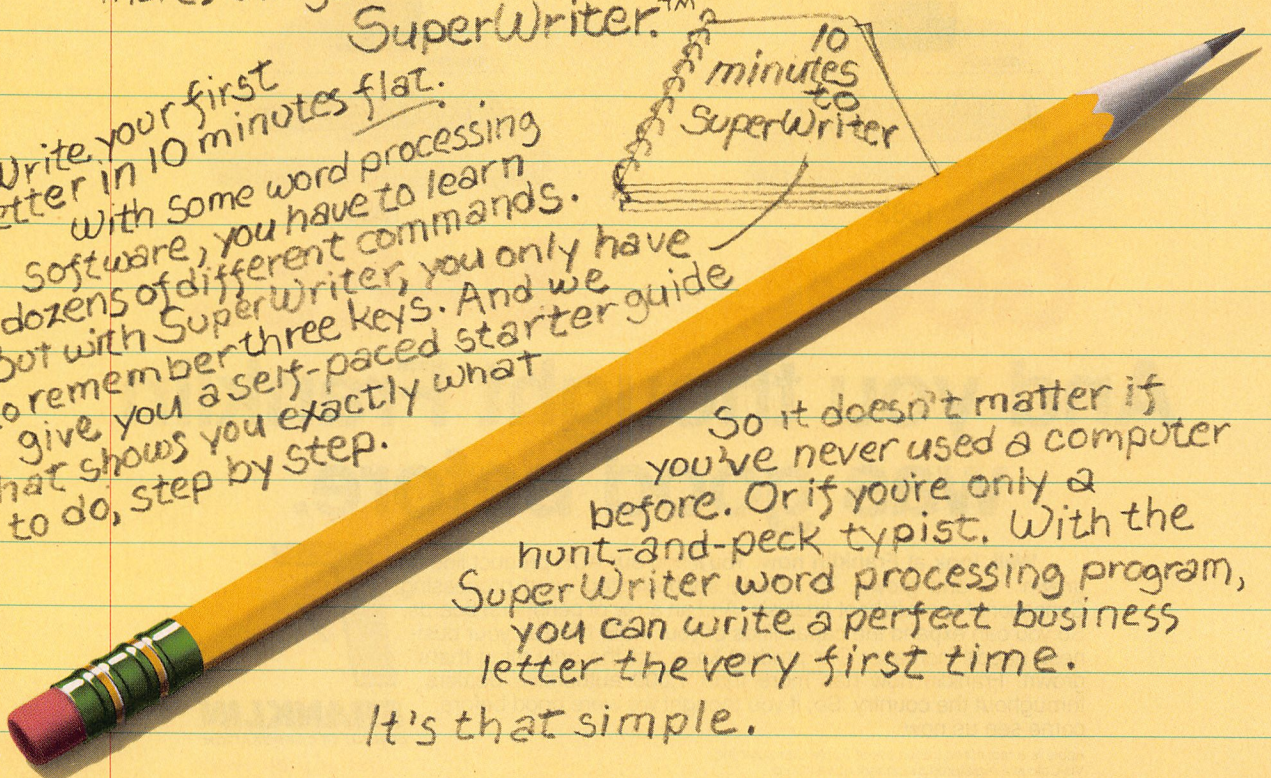
With some word processing software, you have to learn dozens of different commands. But with SuperWriter, you only have to remember three keys. And we give you a self-paced starter guide that shows you exactly what to do, step by step.



So it doesn't matter if you've never used a computer before. Or if you're only a hunt-and-peck typist. With the SuperWriter word processing program, you can write a perfect business letter the very first time.

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Everything you need for only $295.00 - even a spelling cheker.

We're talking about a really complete package here. You get a full-function word processor, our 20,000-word SuperSpellGuard™ spelling checker, and a form letter generator. All for $295.00 suggested retail. To get all these functions any other way, you might have to spend $900.00 or more.

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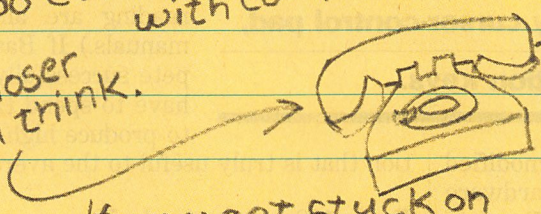
So even if you're a complete beginner, you'll wind up with completely professional results.

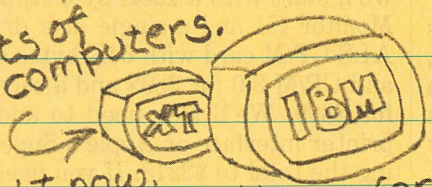
Help is closer than you think.



If you get stuck on a problem with any other word processing software, you'll probably have to go back to the store for help.

But if you have any questions at all about SuperWriter, all you do is pick up the phone. We've got a full-time crew of customer service experts on call, ready to help you out.

Works on lots of personal computers.



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tion is much faster than using a real disk, but for permanent storage your data must be saved on a normal disk before the computer is turned off.

CP/M 3.0

Although it wasn't included with the machine tested for this review, Basis Inc. is now providing the CP/M 3.0 operating system as part of its $2995 system. CP/M 3.0 is a greatly improved version of the well-known CP/M operating system that provides access to the tremendous store of CP/M software. According to David Trebas of Basis Inc., the firm is particularly proud of its CP/M software, which has been modified to take advantage of the 108's many built-in hardware features. These modifications include disk-file date and time stamping (using the serial port as a clock), use of the function keys as user-defined "soft keys," and password protection for disk files. Because CP/M doesn't use all of the 108's 128K-byte memory, the remaining space can provide a 44K-byte print-spooling buffer. When you print out a file, it is actually dumped to this spooling buffer and printed automatically, leaving the system free for other tasks while the printing is done simultaneously.

The Basis keyboard is one of its most impressive features, offering a 9-key cursor-control pad, an 18-key numeric pad, and 15 function keys.

Applications software available from Basis includes the Perfect software series (Perfect Writer, Calc, Speller, and Filer). These programs have also been specially modified to take full advantage of the Basis hardware, and all are available for the unusually low price of $275 when purchased with the computer.

Sales and Service

Because all Basis dealers are also authorized service centers, a Basis 108 can be serviced at the same place it was purchased. Although the company is trying to discourage mail-order sales, its incomplete dealer network may make this impossible for the short term. There were no New England dealers at all when this article was written—the closest was in New York. The situation may have improved by the time you read this; check with the company for dealers in your area.

Documentation

The *Basis 108 Instruction Manual* supplied with the system is a thick three-ring binder that contains a mixture of installation instructions, technical reference material, software modification instructions, and program listings, all apparently photocopied from printer output. Although a good deal of technical information is included, it is poorly organized and is in no sense a tutorial.

I found the Basis manual very difficult to read. It intermixes basic operating instructions with more technical information to such an extent that it's often hard to follow. Finding the answer to a particular question is not easy.

For today's computer user the Basis 108 manual has to be rated as unacceptable. This sort of manual might have been common five or six years ago when most personal computer users were hobbyists who expected arcane instructions, but it is inadequate by today's standards. Commodore, Apple, and IBM (among others) all produce excellent documentation for their systems. (In fact, the first six publications Basis recommends as additional reading are all Apple Computer manuals.) If Basis expects to compete successfully, the company will have to spend the time and money to produce high-quality documentation that is truly useful to the average user.

Basis 108 versus Apple IIe

Should you buy a Basis 108 or an Apple IIe? Let's take a closer look at the trade-offs in prices and features between the two machines.

To the $2995 price of the Basis 108 we'll add $225 for a Basis green-screen video monitor and $50 to have someone program your copy of Applesoft into ROM. This gives a total of $3270 for the Basis system.

To configure a corresponding Apple IIe system, we'll start with a 128K-byte Apple IIe with an Apple Monitor III and a single disk drive at $2195, add an ALS CP/M card with 64K bytes of additional memory and CP/M 3.0 for $399 and a second Apple disk drive for $399. We'll also need to add $225 for a parallel printer interface or Apple's Super Serial Card, bringing the total to $3218. If you need a separate keypad, Apple Computer sells a 22-key unit that provides numeric, function, cursor-control, and punctuation keys for $159. This Apple IIe system comes to $3377, about $100 more than the price for the 108. (Cost for both parallel *and* serial interfaces was not included in the IIe system price because most people use one or the other, not both.)

But price is not the only criterion. The Basis 108 includes 15 special function keys on its keyboard; the Apple IIe has only a pair. On the other hand, the ALS CP/M card provides an additional 64K bytes of memory dedicated to CP/M and a 6-MHz Z80 microprocessor that should give noticeably better CP/M performance than the 2-MHz Z80 used in the Basis. The Apple IIe system also includes a new 560 by 192 graphics mode, and its normal high-resolution graphics mode displays 16 colors, more than twice the number available on the Basis.

The Basis 108 system has five free internal expansion slots where the Apple IIe system has four, and the Basis also provides an RGB video output that is not provided by the Apple IIe. I don't consider the Apple's lack of RGB video important—most people use the normal NTSC video output because high-resolution RGB color monitors tend to be quite expensive. If you really need super color, Video-7 Inc. (Suite 1, 12340 South Saratoga/Sunnyvale Rd., Saratoga, CA 95070) sells two different RGB cards for the Apple IIe as alternatives to Apple Computer's 80-column cards.

Conclusions in this comparison are not easy to reach, and your decision will depend on your particular needs. If you really need all of the features provided in the Basis 108, it will cost you a bit less than an Apple IIe system configured exactly the same way. However, many people won't need all those features. If you don't, for example, need a keypad or RGB video output and need only one interface port (serial or parallel), the Apple IIe system saves you about $150. If you are considering purchasing your *first* computer, the Apple wins hands down. Apple's numerous local dealers, user-friendly software, and truly excellent documentation provide the support that most users need, and these are areas in which the Basis could stand to improve.

Conclusions

For the advanced user who wants a complete system with both Apple II and CP/M compatibility, the Basis 108 is certainly a machine to consider. Although weak in documentation and dealer support, it offers a set of built-in features that includes almost all of the options normally purchased with a personal computer system.

The keyboard is perhaps the most innovative aspect of the Basis 108. Its separate numeric and cursor-control keypads and 15 special function keys make it one of the most comprehensive keyboards available on a personal computer today. On the other hand, its short key travel takes a while to get used to, and the lack of key rollover may cause problems for fast typists.

The availability of Apple DOS and CP/M provides access to the two largest software libraries in existence and ensures a steady supply of up-to-date software for many years to come. You should note, however, that the 108 will not be compatible with all Apple II software due to the unavoidable differences between the two machines.

As an alternative to a comparable Apple IIe system, the Basis 108 may save you some money if you need most of the features it offers. However, it's hard to predict how compatible the Basis will be with newly developed Apple IIe software—its memory-bank switching and 80-column display are handled differently, and it doesn't offer the IIe's new graphics mode.

If you're an experienced computer user in the market for a new machine, I suggest that you take a look at the 108. If you're a beginner, you'll probably be better off with a well-documented, more established and user-friendly system. □

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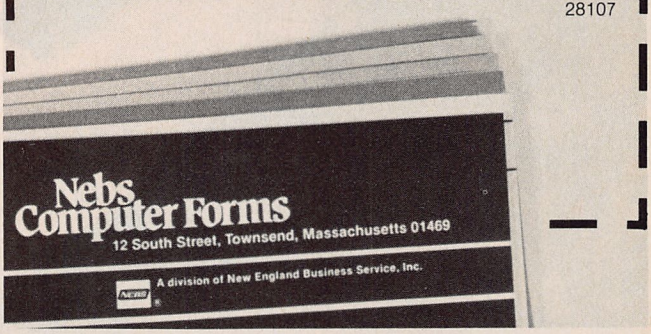

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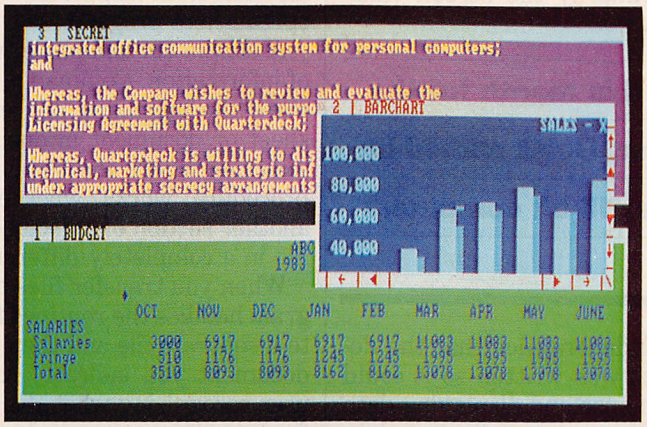
by Michael J. Miller



The Electronic 'DesQ' Top

DesQ lets you run several MS-DOS programs from different manufacturers on screen at the same time.

There's a small, little-known start-up software company in Santa Monica, California, that thinks it can compete with such established giants as Apple and Visicorp in offering integrated software for the "electronic office" market. The people at Quarterdeck Office Systems say their new DesQ operating environment not only can compete with Apple's Lisa and Visicorp's Visi On, but it can go these products one better by giving users access to virtually all MS-DOS software. And judging from recent demonstrations, they may be right.

DesQ (pronounced "desk") displays an electronic desktop, complete with sophisticated graphics, on the IBM Personal Computer and IBM-compatible machines. The display can be divided into many separate areas, or "windows," each of which can contain its own file, such as a word-processing document, spreadsheet, accounting statement, or database. Users of the system can easily transfer information between files, even those created by different programs.

In these respects, DesQ is very much like Lisa or Visi On. It can even use a mouse, a hand-held electronic device that moves the cursor on the screen. But DesQ has one important advantage, according to Quarterdeck's president, Theresa E. Myers: It can run off-the-shelf programs—including Wordstar, Supercalc, and any other MS-DOS programs from *different* manufacturers—whereas software must be developed specially or converted to run on the other electronic-desktop systems.

So the questions arise. Who are these people? And how have they created an operating environment that can do things the new products of the bigger firms can't do?

Quarterdeck Office Systems was established in September 1981 by Myers and three others who had the idea of developing and marketing this product. Myers and Gary W. Pope, Quarterdeck's executive vice-president for software development, had worked together at a number of Citibank subsidiaries, including Axxa Corporation, where they had developed a multiuser office workstation.

Their experience at Axxa had led Myers and Pope to envision a product that would enable financial professionals to move information easily between several different files—for example, from financial files into word-processing documents—using software packages that are commercially available.

Simple New Language

The program to accomplish this task was written in a new language developed by Pope. The language, which he calls "SYMPL," is similar to both Smalltalk and LISP and was specificially designed for the purpose of integrating software packages. SYMPL was written in a standard version of Pascal, so both the new language and the program can be easily adapted to other machines.

DesQ, which is scheduled for release this month, will retail for $395. Quarterdeck plans to aim the system at professionals and executives and will market the product through retail stores. Initially, the DesQ system will be available only for the IBM PC and IBM-compatible computers using the MS-DOS operating system. It requires a minimum configuration of 256K bytes of random-access memory (RAM), a 5-megabyte Winchester hard disk, and a 25 by 80 display, either monochrome or color. DesQ, along with the operating system, resides in 128K bytes of memory.

Michael J. Miller is the West Coast editor of *Popular Computing*.

← Circle 34 on inquiry card.

Because the language used is quite portable, Myers said, the system should be available soon for other 16-bit computers with MS-DOS. Adapting the program should be fairly simple, Myers said, with any required changes affecting primarily the screen characters, menu, and keyboard.

Scheduled for release this month for the IBM Personal Computer, DesQ should be available soon for other 16-bit computers with MS-DOS.

As part of the hardware independence that the designers wanted, the program was written so it could have the options of using a mouse and displaying data in color. On an IBM system, the program displays data in full color on a color monitor but in green and white on a monochrome monitor. On a Compaq computer, the monochrome monitor displays the data in varying shades of gray. If you use a mouse with the system, you need a two-button setup. The first button selects a particular location on the screen, while the other transfers data between different levels of menus. Without a mouse, you access the same capabilities by moving cursor keys and entering a question mark.

Windows on the World

The DesQ system gives you a great deal of flexibility in dealing with windows, each of which can run its own program. For each file to be opened, a user can define the size and color of a window. When first calling a file, you have a number of options: You can define the window to fill the entire screen; the top or bottom half; the left or right half; the top, middle, or bottom thirds; or any of the four quarters.

Once set, a window can be resized to any dimensions simply by moving a corner of the window with the cursor. And at any time, the Zoom command can enlarge a window to full-screen size.

Windows can overlap other windows or be put aside until needed later. You use a mouse or a keypad to switch between windows at the touch of a button. The number of windows is limited only by the amount of available memory. And the color of the windows is limited only by the hardware, Myers said.

Cut and Paste

DesQ allows easy transfer of information between files. For instance, information from a spreadsheet program can be moved into a word-processing document or material from an accounting package can be placed in a spreadsheet program.

A simple cut-and-paste function handles the transfer of information. Commands built into the system let you mark the beginning and end of a section of a spreadsheet or document in one window and then mark the locations where the section should be moved to. This procedure works whether the final destination is another section of a document in the same window or a file in a completely different window.

When you transfer files between documents, the program handles the routines for moving the cut section into a separate file and then pasting the new file into the document you indicate. And it does this without the user recognizing what the computer is doing. Only the final result is apparent. In a similar manner, the system easily transfers material from a spreadsheet file to a pie-chart program, creating a graphic representation of the information.

Customized Functions

DesQ really shines at customizing reports or functions. For instance, you can "teach" the system to call up a mainframe computer for financial information and then enter the information into a spreadsheet program.

The system's initial configuration lets you customize DesQ with up to 10 different programs, all accessible by touching a button. For example, you can use one button to call Wordstar, another for Supercalc, another for Peachtree General Accounting, and so on. At the same time, you can send standard initialization strings to the programs. That way, you can tell a word-processing program to turn off justification, to change the line spacing, or to set the margins at a predefined place.

The system can also be used to create functions that combine several different programs. Such functions might include a card file, action tracking, or month-end reports. Myers said she expects that users will customize the system themselves for specific functions or enlist the help of experts.

Myers demonstrated a month-end function that is accessed just by pushing a button. The system then automatically takes information from a general-ledger package and checks the trial balance. If the accounts balance, the program takes

At a Glance

Name: DesQ

Type
Integrated operating environment

Manufacturer
Quarterdeck Office Systems
1918 Main St., Suite #240
Santa Monica, CA 90405
(213) 392-9851

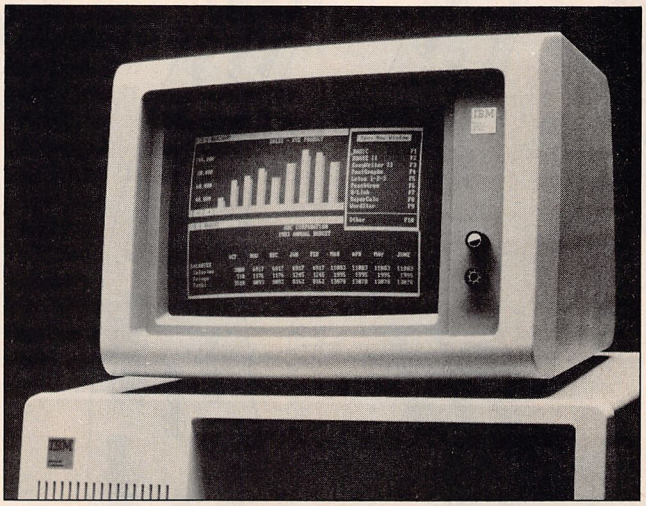
Price
$395

Format
5¼-inch floppy disk

Computer
IBM Personal Computer (or IBM-compatible computer) with MS-DOS, 256K bytes of RAM, and a 5-megabyte hard disk

Documentation
Not available yet

Audience
Professionals and executives who want to run several applications programs simultaneously



DesQ runs on an IBM PC with 256K bytes of RAM and a 5-megabyte hard disk.

an income statement created by the package and transfers the information into a spreadsheet file. Such cross-applications can let the system do routine reports for the executive, she added.

Unanswered Questions

Although demonstrations of the program are impressive, several questions still remain. While the DesQ system appears to work quite well in moving material from a spreadsheet program to a word-processing document, it is hard to tell before further product testing by the company how well the system works when transferring files between, say, different database programs with different record-keeping formats.

As it handles data transfer between files, DesQ is designed to go through a decision-tree process. It compares input and output formats for the programs involved, including DIF (Data Interchange Format) and ASCII (American National Standard Code for Information Interchange) files. If all else fails, the DesQ system attempts to take the data on the screen and put the information into the program as if it were being typed in.

For such a database transfer, a user can "teach" the system how to transfer the first record, Myers said. Then DesQ can follow the procedure for subsequent records.

Because the system requires a hard disk and a relatively large amount of memory and because it currently requires MS-DOS or PC-DOS, DesQ may be beyond the range of most current computer owners. But for professionals and executives hoping to run several different applications, such system requirements may not seem so great. DesQ appears to be a giant step forward toward the goal of combining software functions, particularly for users who do not want to trade in their current software. □

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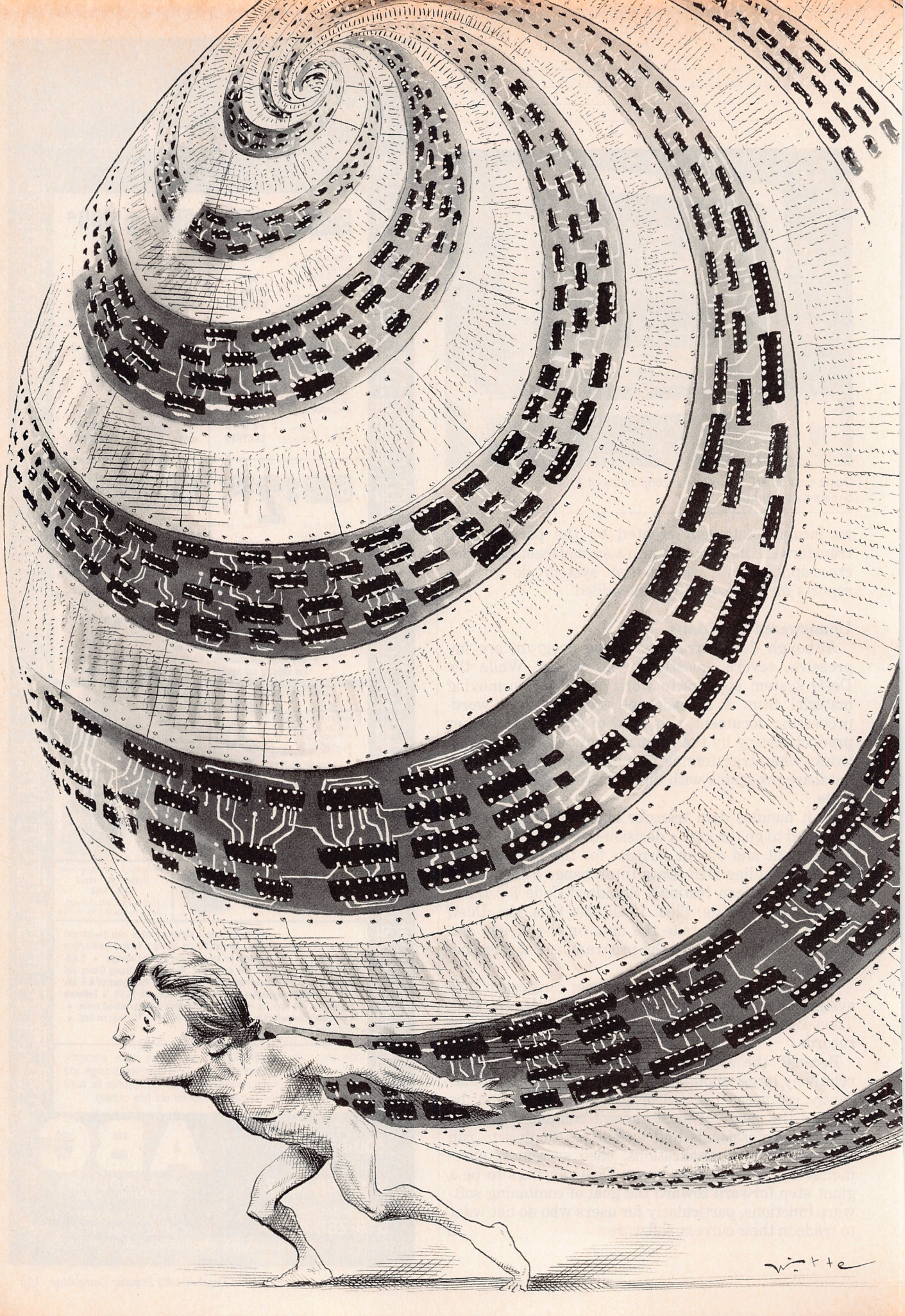
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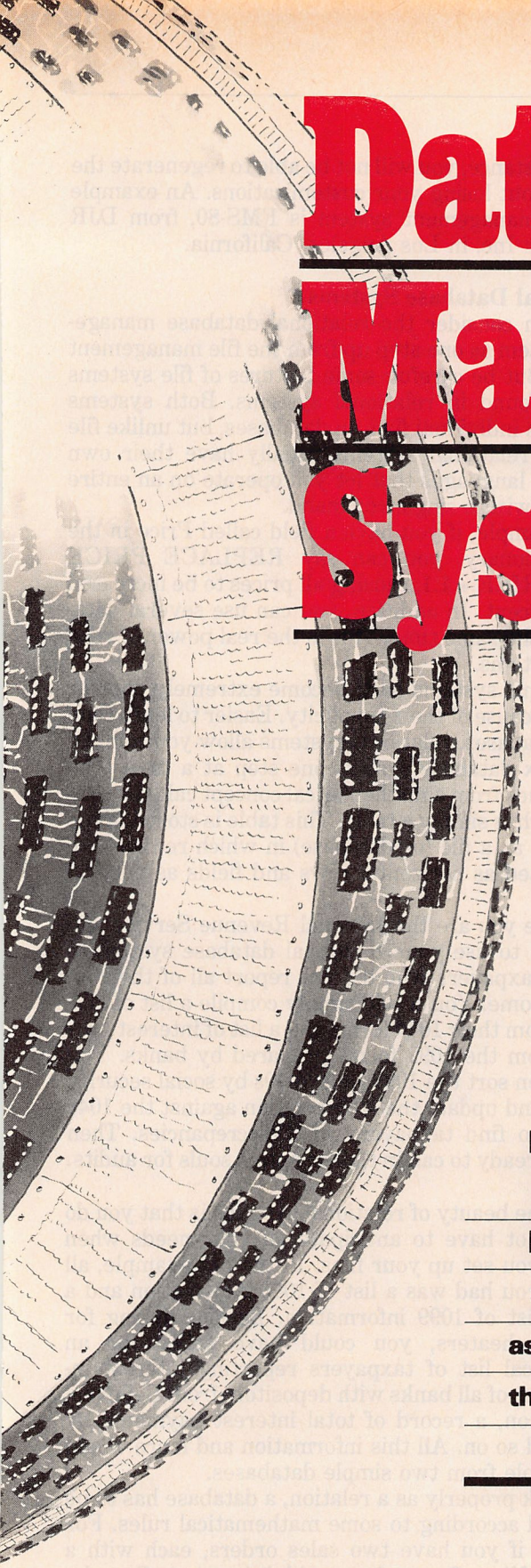

Database Management Systems

by David Kruglinski

Contrary to popular belief, database management systems aren't that complex. In fact, once you understand the terminology involved, you can quickly begin to compare the individual packages currently available. Three main types of database management programs are widely used today: file management systems, relational database management systems, and network/hierarchical database management systems. This article will define each of these three types and present some standards for comparing and evaluating packages that run under the CP/M operating system.

If the systems seem as unwieldy as the data you want them to manage, this guide's for you.

File Management Systems

File management systems (also called data management systems or information management systems) were available long before the term database became popular. A file management system automates the construction of business programs and concentrates on file definition, data-entry programming, sorting, and creating reports. Such a system allows nonprogrammers to put together straightforward business programs.

Traditional file systems aid in the creation of single-file systems and often provide indexes for direct access. For example, assume that you receive mail and phone inquiries in response to an advertisement you place in a computer magazine. You can use a file system to record customer contacts. You would have one record per customer, with each record typically including information such as the customer's name, address, and phone number, the date contacted, and a record of the product of interest. Each record

David Kruglinski is president of a Seattle dealership of database management software for business applications.

Illustrations by Michael C. Witte

would have its own identification number.

The format of the file is defined by your telling the computer the name and length of each field (i.e., each individual piece of information) and whether the field is numeric or alphabetic. You do this simply by choosing one of the options displayed on the menu the file system gives you. Once these parameters are set, you may enter data for as many customers as you like.

To search for a particular customer, you enter the ID number; the program either scans the whole file sequentially or uses the index to find the customer directly. Once the record is found, you may delete it or modify it using another menu.

Another of the file system's menus lets you define and print reports such as a customer list for the sales staff. You specify the fields to be printed, the column headings, and report's title. The program stores these specifications on disk for future use. In this way the system could generate a list of customers interested in a certain product and print mailing labels or form letters.

This may sound like a trivial application, but programming it in BASIC could take days. Many record-keeping chores are easily handled by file systems, allowing nonprogrammers to accomplish them with no difficulty. If your program isn't powerful enough, however, you could hit a dead end when your database reaches a certain size. Sensitive to this shortcoming, system designers have been increasing the power of their packages. For example, at least one file system contains its own programming language.

Recently developed file system programs can handle multiple files. With these you can process an invoice file and then look up the customer's name in another file based on the customer number. Some programs let you build systems with transaction files, multiple master files, historical transaction files, and even your own menus.

Much attention has been focused lately on program generators, which purport to have made programmers obsolete. Actually, the program generator is just a special type of file system. Except for a time-consuming step where a number of BASIC programs are "generated" to disk, the end results of the program generator and the file system are the same.

A conventional file system stores the data dictionary, report formats, and menu-control information in special disk files. The program looks at this control information, reads your response to its menu, and then figures out how to enter data and print reports. A program generator system codes all the control information right into the BASIC program it generates. You can always customize the program after it has been generated, but if you decide to change the record layout, for instance, you will not be able to regenerate the code without losing your customizations. An example of a file management system is FMS-80, from DJR Associates Inc. in Los Angeles, California.

Editor's Note: This article and its illustrations are adapted from *Data Base Management Systems: A Guide to Microcomputer Software*, by David Kruglinski (Osborne/McGraw-Hill, Berkeley, CA, 1983), and have been edited and reprinted by permission of Osborne/McGraw-Hill.

Relational Database Systems

You can consider the relational database management system as one step up from the file management system. But be careful: some features of file systems are not found in relational systems. Both systems work with individual files on databases, but unlike file systems, relational systems usually have their own computer languages that let you operate on an entire database with a single command.

For example, if you have a field called Price in the data dictionary, you can say REPLACE PRICE WITH PRICE * 1.1, causing all prices to be increased by 10 percent. In addition, you can use several databases at the same time. This is the real power of relational systems.

Relational systems have become extremely popular chiefly because of their simplicity. Easier to learn than other databases, relational systems allow you to build a complex database system one step at a time. The name comes from a mathematical concept called a relation, which is simply a table. This table is stored in the computer as a file (or database) in which records are represented as horizontal rows and fields as vertical columns.

Suppose you are the Internal Revenue Service and you want to use your relational database system to identify taxpayers who did not report all of their interest income. You would simply compile a list of taxpayers from their 1040 forms and a list of interest payments from the 1099 forms prepared by banks. You would then sort the 1099s and 1040s by social security number and update the 1099 relation against the 1040 relation to find taxpayers with discrepancies. Then you'd be ready to call in those hapless souls for audits.

The beauty of relational systems is that you do not have to anticipate all your needs when you set up your files. In the tax example, all you had was a list of 1040 information and a list of 1099 information. Besides asking for the tax cheaters, you could have asked for an alphabetical list of taxpayers reporting interest income, a list of all banks with depositors from Bellevue, Washington, a record of total interest payments by bank, and so on. All this information and more would be available from two simple databases.

To work properly as a relation, a database has to be organized according to some mathematical rules. For example, if you have two sales orders, each with a number of lines for products sold, it is not at all a relation unless it is set up properly as a table with rows and columns. Each row must have the same number of columns, and the same specific format must be followed throughout.

Furthermore, in any relation there is a unique way

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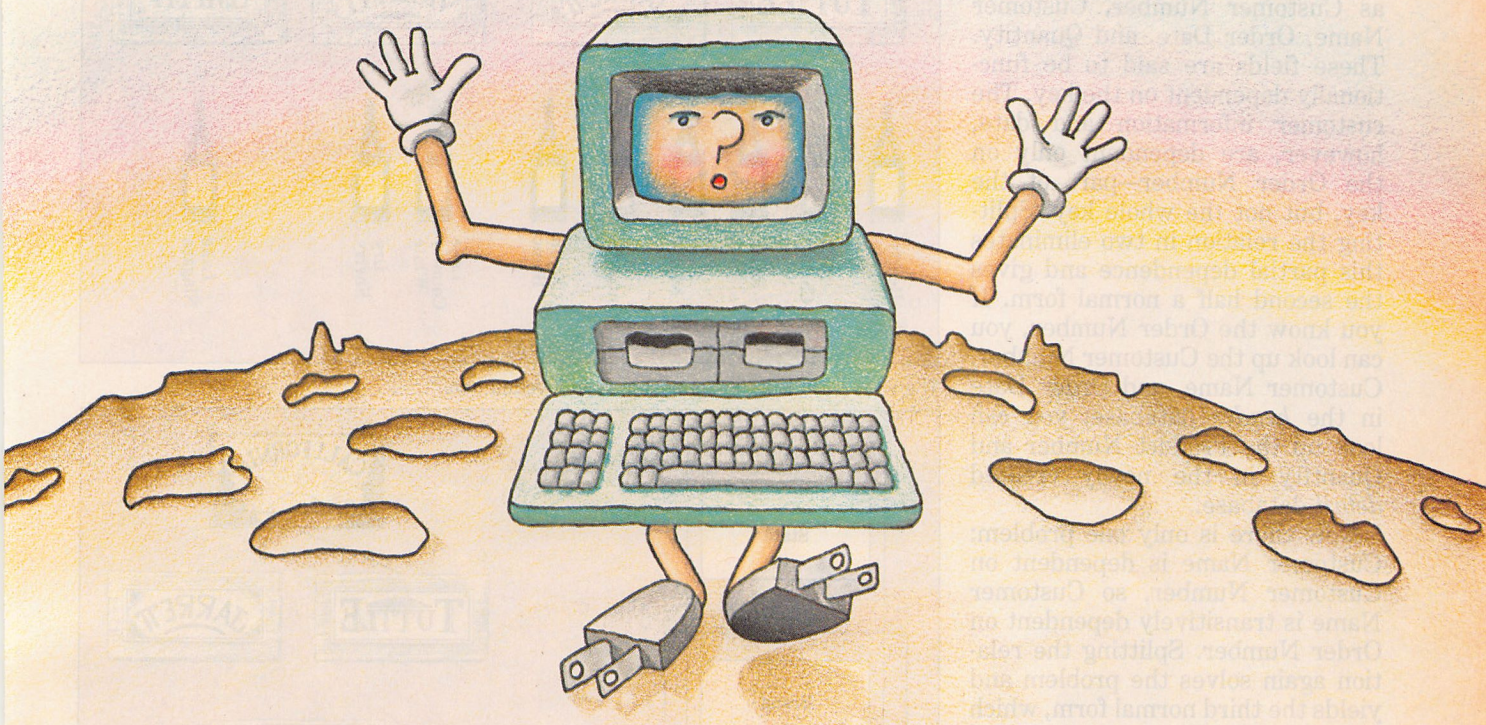

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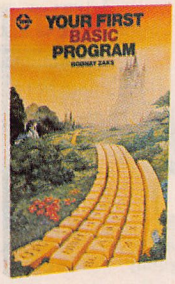

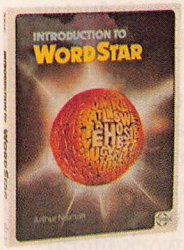

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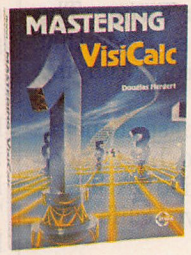

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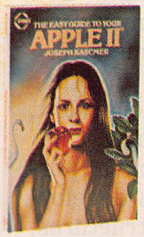

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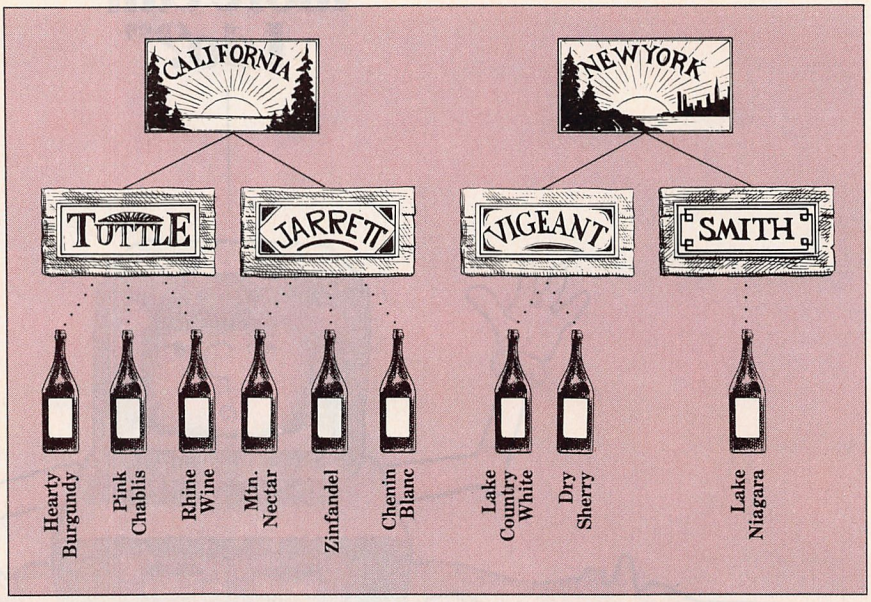
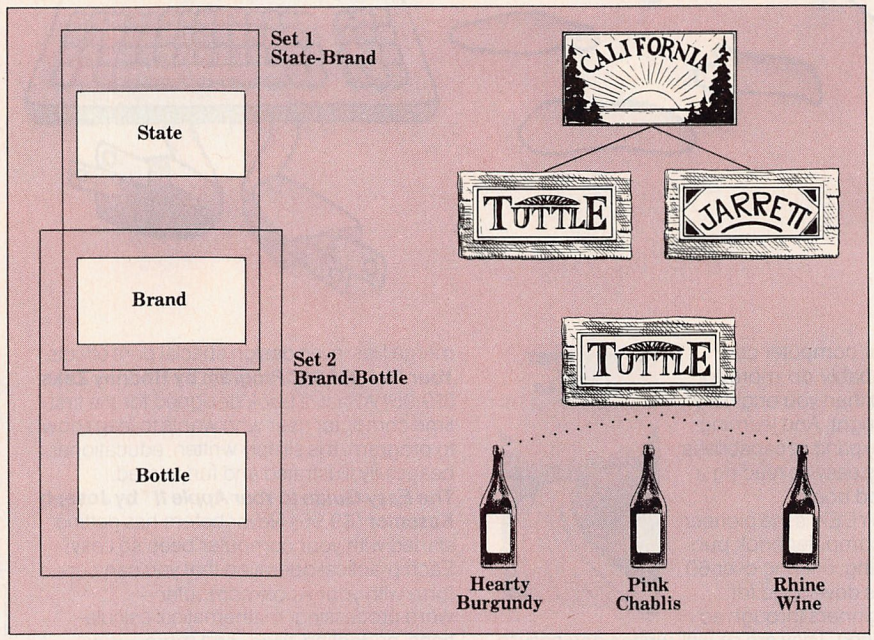
of identifying the rows: you specify one or more fields as the key to the records. In a sales-order relation these keys might be Order Number and Product Number. If you know those two values, you can look up other information such as Customer Number, Customer Name, Order Date, and Quantity. These fields are said to be functionally dependent on the key. The customer information and date, however, are dependent only on the Order Number—part of the key, but not the whole key. Splitting the relation in two eliminates this partial dependence and gives the second half a normal form. If you know the Order Number, you can look up the Customer Number, Customer Name, and Order Date in the *header* database; you can look up the Product Number and Quantity in the newly created *detail* database.

Now there is only one problem: Customer Name is dependent on Customer Number, so Customer Name is transitively dependent on Order Number. Splitting the relation again solves the problem and yields the third normal form, which is the best model of the data. You have to go into the customer database to look up the name every time you want to print an order header, which is a little more work, but there is less redundancy.

Computer scientists have pursued this logic further in developing more complex data structures, identifying the fourth and fifth normal forms. They attack this with the zeal of a physicist searching for new subatomic particles, but little of this truly concerns the microcomputer owner. The relational idea we're concerned with is so basic that you can begin to see how it works just from studying examples.



The wine cellar is at first arranged as an inverted tree.



Applying a network/hierarchical structure, you define two sets.

Two currently popular relational database management systems are Condor II, published by Condor Computer in Ann Arbor, Michigan, and dBASE II, published by Ashton-Tate in Culver City, California.

Network/Hierarchical Systems

Of all microcomputer database management systems, the network/hierarchical database management system is (for better or worse) the closest copy of commercial database systems in general use on large computers. This is no accident—the leading package started with standards set by a computer industry group called CODASYL (Conference on Data System Languages).

If you use a file management system, you are used to looking at your data as physical files (just as you would if you were a BASIC or COBOL programmer). You have a collection of records, each divided into fields. The relational system continues with this approach but uses different terminology. The network/hierarchical system, however, departs radically from this approach and applies a different logic to the data as a whole. The physical layout of the data is no longer of concern to you, so you can forget about files even though records, fields, and data items still remain.

You have already seen that the relation or table is

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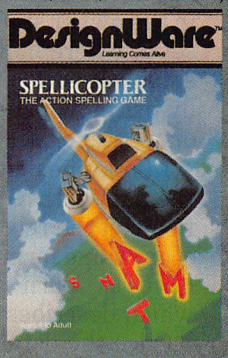

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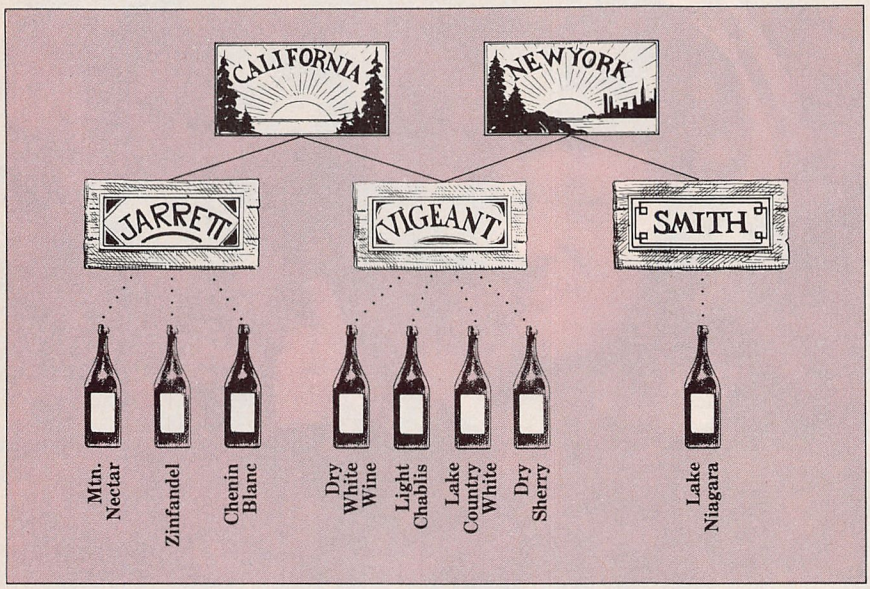


Modified network structure represents Vigeant wineries in two states.

the basic unit in relational systems. In the network/hierarchical system, on the other hand, the basic unit is the set. The best way to understand sets is to study an example borrowed from James Martin's *Computer Data Base Organization* (Prentice-Hall, 1977).

Martin is obviously a connoisseur of fine wines, as well he might afford to be. You, however, have spent your last nickel on a new 20-megabyte hard disk, and you have to settle for less in the way of luxury. Your wine comes not from France but from California or New York; it isn't distinguished by region, but by brand name. In order to illustrate the principle of sets, we will use four fictitious wineries named Tuttle, Jarrett, Vigeant, and Smith. Tuttle and Jarrett are in California; Vigeant and Smith are in New York.

Let's say the wine in your cellar is arranged by state, winery, and brand name in a kind of upside-down tree as shown in the upper figure on page 120. Applying a network/hierarchical system structure, you define two sets as shown in the lower figure. Set 1 has as its "owner" one state—in this case either California or New York—and has for its members the different brands of wine made in the owner state. Each brand, in turn, is the owner in set 2, where individual bottles are members. You can establish sort orders within the sets, sorting bottles by price, alphabetically by name, by date of purchase, or whatever scheme is useful.

In relational systems you specify the organization of the data with a data dictionary and have one entry per field; all the records in the database are assumed to be of the same form. In network/hierarchical systems you have to learn a data description language (DDL), which describes the structure of the data.

Once the database is defined, you're in a position to use it. Because network/hierarchical systems do not focus on direct interactive data retrieval, you'll have to write some programs. Large computer systems have a data manipulation language specifically geared to working with data structures, but as a microcomputer owner, you'll have to use a host language such as BASIC, COBOL, or PL/I.

Because these compilers aren't designed for databases, you have to shoehorn in your data-access commands by issuing call statements to the database software. A call statement is just a way of exchanging information with the database management program already in the computer's memory.

In order to make the wine example as simple as possible, assume that your host language has built-in data-manipulation commands. A program written in this imaginary language to list all wines by state and brand would look something like this:

```
OPEN THE DATABASE
PRINT "Wine List by State, by Brand"
FIND FIRST MEMBER OF SET0
DO WHILE NOT END OF SET0
  PRINT "State ="; STATE
  SET OWNER OF SET1 BASED ON MEMBER OF SET0
  FIND FIRST MEMBER OF SET1
  DO WHILE NOT END OF SET1
    PRINT "Brand ="; BRAND
    SET OWNER OF SET2 BASED ON MEMBER OF SET1
    FIND FIRST MEMBER OF SET2
    DO WHILE NOT END OF SET2
      PRINT "Name ="; NAME;
      PRINT "Price="; PRICE
COMMENTS      FIND NEXT MEMBER OF SET2
            END DO
          END DO
        END DO
        PRINT "End of list"
        CLOSE THE DATABASE
```

Most of these statements will be familiar to you if you have programmed in BASIC or Pascal, but the statement SET OWNER OF SET2 BASED ON MEMBER OF SET1 may not be obvious. Remember that the wine brands are at the same time members of set 1 and owners of set 2. If the program is stepping through the brands in set 1 and gets to Jarrett, it is now ready to make a switch and consider Jarrett the owner of set 2 so it can step through those bottles. Perhaps it's more helpful to read the statement backwards as "make the member of set 1 the owner of set 2."

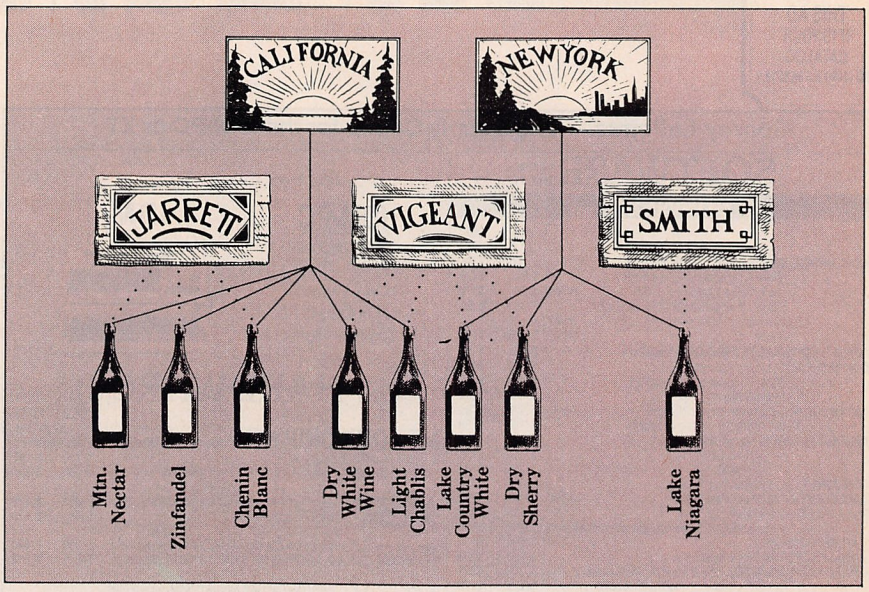
Looking at the program again, you'll notice that there are three concentric loops, one for each set, and

that the program follows the structure of the tree, exploring each branch in sequence. The wine example so far has been strictly hierarchical. But suppose you learn that Vigeant wineries are located in both New York and California; in this case the model of your data breaks down if you ask, "What wines does Vigeant make?" You must now move on to the network model, of which the hierarchical model is just a special case.

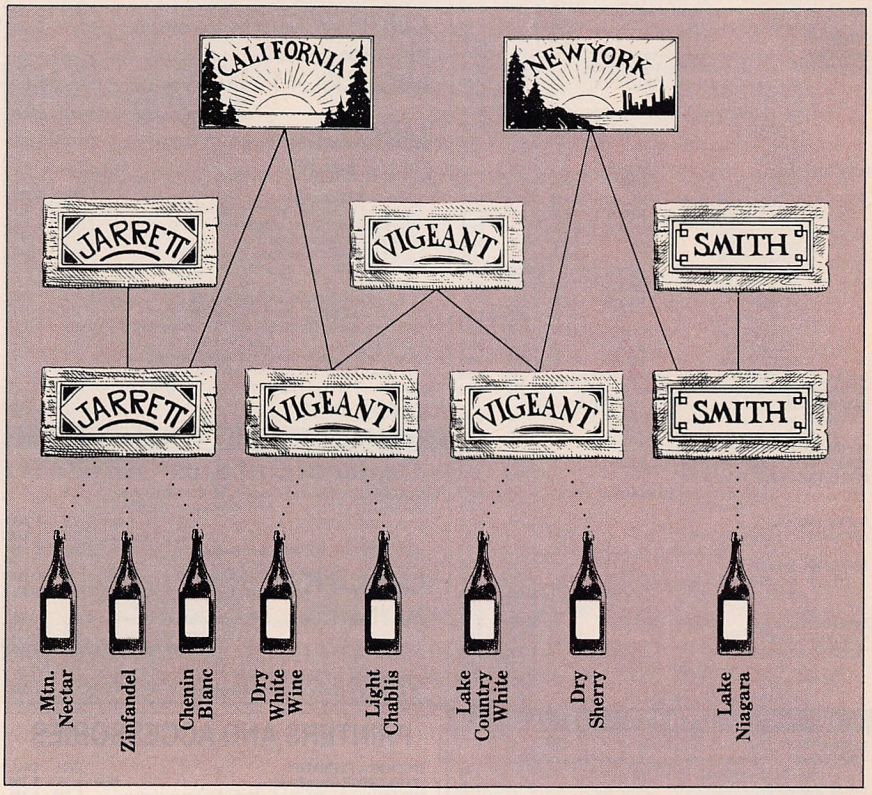
The figure on page 122 shows the first example of a network model in which the Vigeant winery is now a member in both the New York and California sets. Unfortunately, you no longer know whether Lake Country White comes from New York or California—this structure is clearly not an adequate model of your wine cellar.

Consider, instead, a different model as shown in the upper figure on this page. It lets you list all wines by state and by brand. Because it does not lead to false conclusions about the origins of your wine, this model is accurate. On the other hand, this model does not allow you to easily find all Vigeant wines from California.

Our final network model, shown in the lower figure, is the most accurate and complete. However, although the problem is simple, the complexity of its solution is overwhelming. If you choose any of the new models shown in the last three figures, you must completely rewrite the listing program. As you can see, design and implementation of a network system requires much analysis and care. You must be certain that the fundamental structure of your data will not change, and you must be able to write programs in an established computer language. In return, you get the full use of all the features of both the language and the database management system, and there is little to restrict you in developing your system. Also, such a data structure lends itself to efficient storage and quick access. One network/hierarchical system is MDBS III, published by Micro Database Systems of Lafayette, Indiana.



This more accurate model still allows confusion about Vigeant's two wineries.



Careful analysis and design leads to this most accurate and complete model.

Evaluating Database Systems

As a basis for evaluation, let's discuss specific features of database management systems. Some of these features are necessary elements, and others are considered useful options for particular applications.

In general, the file management system is the easiest to learn and simplest to use. It is a menu-driven system that works especially well for home and office applications such as address lists, collections, and inventory.

The relational database management system gives you most of the file management system's capabilities

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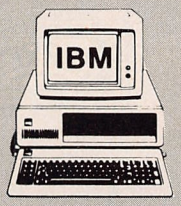

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	Smartmodem 1200 (RS-232)	$ 699	$ 535
	IBM-PC Smartmodem 1200 B plus Smartcom II	$ 599	$ 439
	Micromodem 100 (S-100 bus)	$ 399	$ 275
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	NOVATION, Applecat II Modem, 300 BAUD	$ 389	$ 269
	212 Apple Cat. 1200 BAUD	$ 725	$ 599
	SIGNALMAN, Modem MKI (RS-232)	$ 99	$ 79
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	ModemCard for the Apple II	$ 299	$ 259
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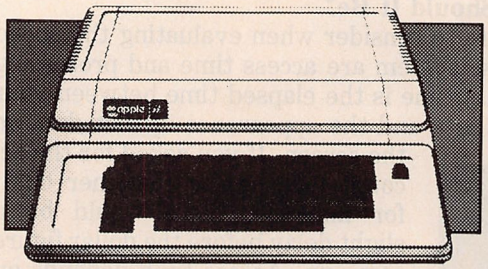

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Rana	Elite 1, 163K, 40 Tracks	$ 379	$ 269
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Micro Telegram	$ 250	$ 99
Microsoft, 16K RAMCard for II+	$ 100	$ 79
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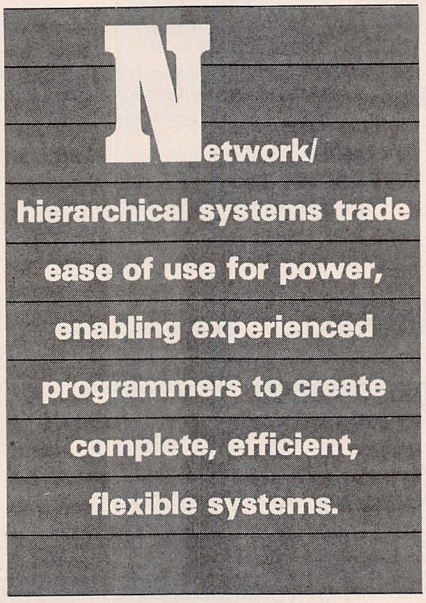
as well as greater data-manipulating ability. You do have to learn the system's language and understand some abstract data-modeling concepts, but once you become acquainted with a relational system, you'll be in a position to take advantage of its power and sophistication. A relational system is handy if you need to experiment with your data or if you can't plan your whole system in advance. Setting up routine but foolproof business databases with relational systems is hard work, but those databases will be more flexible in the end. Both file management and relational systems are suitable for use by people who are not computer professionals.

The network/hierarchical system trades ease of use for power, enabling a programmer to create complete applications that are both efficient and flexible.



How Should It Be Driven?

Menu-driven database management systems are certainly the easiest for an inexperienced user. Just having a menu, though, is no guarantee that it will be understandable. Some menus offer too many choices and are worded in a way that is difficult to understand. Menus work best when they offer a limited number of options that follow a tree structure. This means that a choice from the main menu brings up a secondary menu with new array of choices, and so on down the tree.

Command-driven systems make for more concise and flexible databases but require that you learn special commands. On one level, commands can be more trouble than they're worth. Take the command RENAME FILE1 TO FILE2. This would be simpler with a menu in which the computer asks you for the file's old name and then the file's new name. On the other hand, a command to calculate gross margin percent, STORE 100 * (MARGIN/GROSS) TO PERCENT, would be difficult to structure on a menu and is best handled by a specific command.

Program-driven systems are the other alternative. In a command-driven or menu-driven system, you are controlling every data-processing step from your keyboard. But suppose you have worked out a complicated procedure that you want to repeat often. Almost every database system offers you a way of saving a sequence of commands or menu choices as a disk file that can be edited and invoked by its name when you wish to run it. This disk file could be considered a program, but not in the same sense as a BASIC or COBOL program. A real program is a sequence of instructions that can be designed to perform almost any operation on any part of your data. With the addition of control instructions, a program can test for conditions and then alter its flow. Any database system that uses this type of program is said to be procedural, while systems that offer menu choices, blanks to fill in, or global commands like LIST ALL PRICES is termed nonprocedural. Packages allowing both procedural and nonprocedural control are the most flexible.

How Fast Should It Be?

Two factors to consider when evaluating the speed of a database system are access time and processing speed. Access time is the elapsed time between your request for data and the appearance of that data on the screen. If you asked for the account balance for customer 0231, for instance, there would be a slight delay before the dollar figure came up. Access time depends on your computer hardware, particularly on the disk drive. When comparing the access times of several database management system packages, make sure that the hardware configuration is the same for each. A hard disk can access data many times faster than a floppy disk, 8-inch floppy disks are faster than 5¼-inch ones, and a 4-megahertz (MHz) microprocessor chip makes a program run twice as fast as a 2-MHz chip (provided the disk can keep up).

The system's access method—direct, indexed, or sequential—also influences its access time. Direct access is the quickest; it depends only on the disk, not on the system. The speed of a system using indexed access depends on the algorithm used. Packages written in BASIC can be almost as fast as those written in assembly language, indicating that the disk access itself is critical. Sequential-access speeds, like indexed speeds, vary widely among packages. Generally speaking, a slow package ought to offer some offsetting advantages.

Processing speed, the other consideration, is something you can control to some extent when you set up the database. Knowing which will be the most frequently asked questions will enable you to arrange the data for quicker access. Modern database packages are no longer written in interpretive BASIC but rather in assembly language or a compiled language such as CB-80. Both are fast, but the compiled-language programs need more memory space and must swap code from disk more often than assembly-language programs. You will also notice more delays when going from function to function with the compiled program.

How Much Storage Will I Need?

The size of a microcomputer database is generally limited by the CP/M operating system. Version 2.2, the most widely used, has a built-in limitation of not

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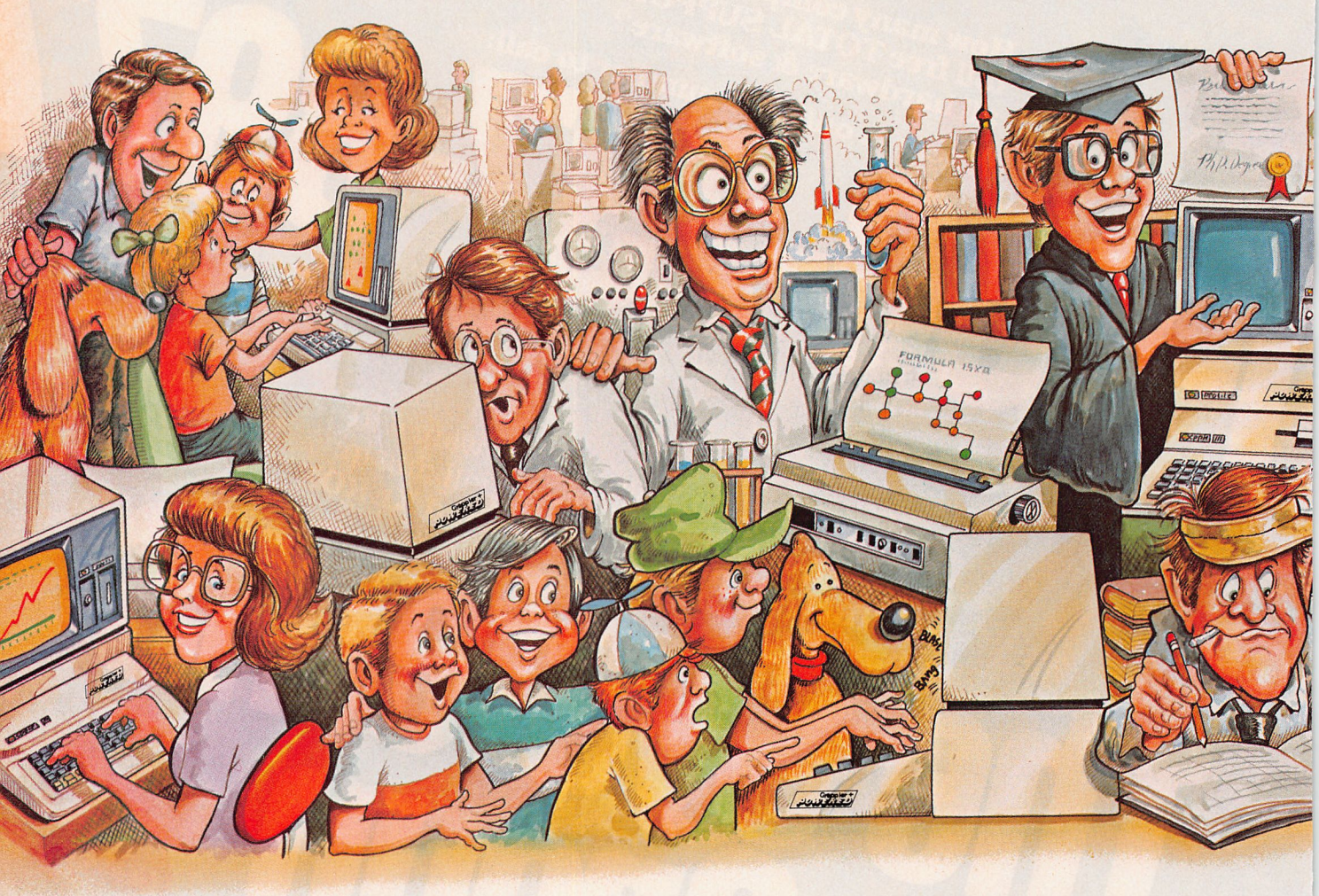

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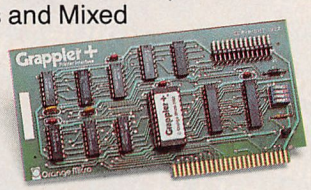

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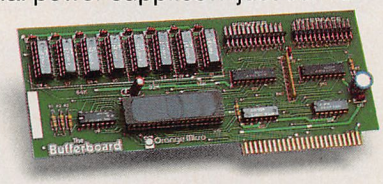

*Versions for standard Grappler + , Epson APL and Apple Parallel Interfaces.

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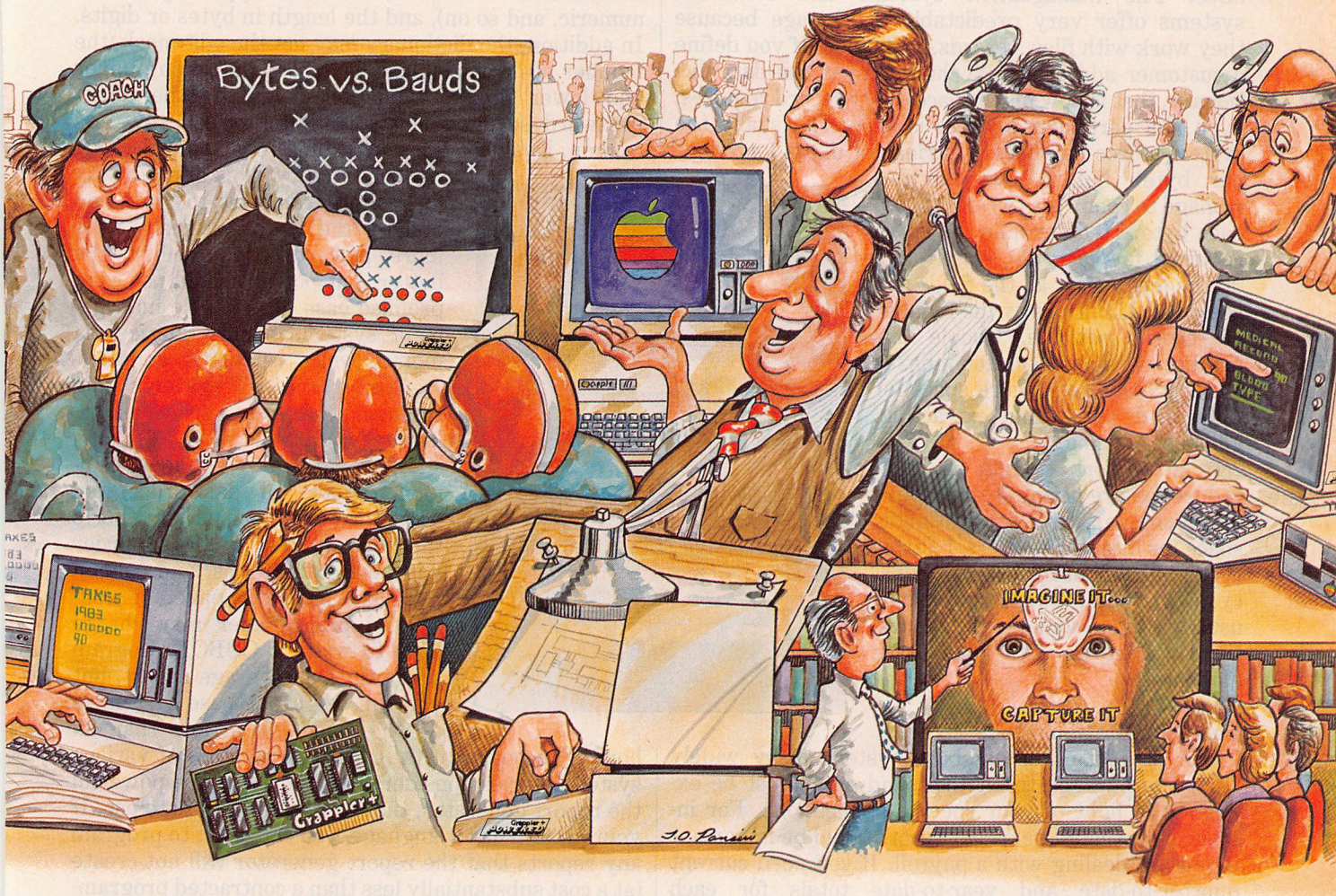

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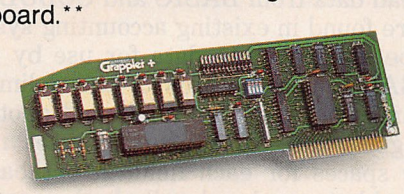

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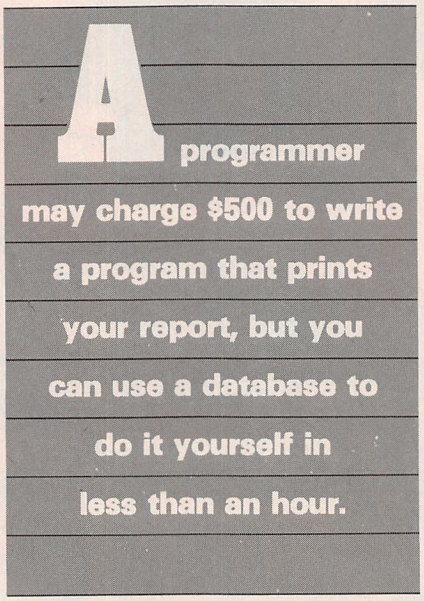
quite 8 megabytes per file. However, unless you have a large-capacity hard disk, you won't even approach this limit. Instead, you will have to worry about squeezing your data into the limited disk space you have. File management systems and relational systems offer very predictable disk usage because they work with files, records, and fields. If you define a customer address as 25 characters in the data dictionary, that is how much space every record requires, even if a particular address is shorter. Usually the system stores numbers as strings of digits (one digit per byte), but a few packages manage to compress two digits into each byte. To determine the space required for each file, simply add up the lengths for all the fields in a record and multiply by the number of records per file. Double this number to allow room for indexes and leave adequate work space for tasks such as sorting, extracting, and reorganizing.

In a network system the procedure for predicting disk usage is more complex. You have to allow space for internal pointers, but this is partially offset by less redundancy in the data. You'll find that it usually takes some experimentation to come up with good space estimates.



Some Limitations

The limitations of database systems vary widely from one package to another, and each must be examined in light of your specific applications. For instance, maximum fields per record could be important if you are dealing with a payroll. If you need current quarter-to-date and year-to-date totals for each employee, as well as personnel information, a system with a 32-field limit won't be sufficient. A maximum of 256 bytes per record, as imposed by some versions of BASIC, could severely limit many systems. A limit of 10 digits of precision could give you trouble in an accounting system for a corporation large enough to have balances of $100 million or more. Also, consider how many files may be used at the same time. If your system permits only two, you will probably outgrow it rather quickly.

Required Features

Here's a quick rundown of the specific features and capabilities you should find in all commercial database management packages:

•*Data dictionary*: The dictionary is the heart of the database. It tells you almost everything about the data. File management and relational systems use a dictionary to describe individual files or databases, but network/hierarchical systems use it to describe the entire database, that is, all the data in the system. In the latter case, the data relationships are encoded in the dictionary.

Each field has a dictionary entry that specifies the field name or number, the data type (alphabetic, numeric, and so on), and the length in bytes or digits. In addition, the dictionary may list the edit mask (the number of decimals, leading zeros, and so on), upper and lower limits, validation fields in other files, password security levels, and the screen row and column. Evaluate these according to your needs.

•*Query facility:* This offers a way for nonprogrammers to view and update the data. Basically, the more powerful this facility, the better, but power should not compromise ease of use. File management systems handle queries via menus while relational and network/hierarchical systems use commands (actually a special query language).

•*Report generator:* The most common request of data-processing departments is for special reports that list data in a certain order with subtotals, totals, and column headings on each page. A contracted programmer may charge $500 to write a COBOL program that prints an average report, but you can use a database system to do the same job in less than an hour. The power of the report generators of various systems varies considerably, but the more powerful the report generator, the more complex it is to use. If your system has a language, you can use it to program any reports that the report generator will not create (at a cost substantially less than a contracted programmer's figure).

A good report generator lets you select, both from the field and from the records, certain data for printing. For example, you could select name and city from the fields and then all out-of-state vendors from the records. The report generator, then, is just an extension of the query language that is oriented to paper instead of to the video screen.

•*File compatibility:* The database system must be able to read data from BASIC and COBOL programs as they are found in existing accounting systems, and it must be able to write data for use by these programs. BASIC uses records of the delimited type, with commas between the fields and quotes around the strings, while COBOL uses a set number of character spaces for each field. A database system should be able to read and write both record types.

•*Restructuring ability:* In order to understand this feature, imagine that it is 1973 and your job is to put together for an auto club a gas-station database that lists price per gallon in different cities and states.

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Because gasoline is only 39¢ a gallon and disk storage is very expensive, you allow two positions for the price and sandwich the price field between the state and brand fields. This system works well until 1979, when the price rises above $1.00 per gallon. You must now restructure the database to allow for the new price.

Fortunately, the system's designers foresaw that changes would be necessary and provided a way to restructure the database. This restructuring ability allows the programmer to change the price field to four digits. (This fix should hold for at least five years.)

•*Error handling:* When you make a simple error, your system should not crash or destroy all your data. (Granted you may have made frequent backups, but it is irritating to have to use them all the time.) A good database system must give you clear, helpful error messages and let you correct the problem. It is difficult to recover from hardware problems, but common snags like full disks and directories, offline printers, and so on should have been anticipated. If the disk fills up, the system should warn you and give you a chance to delete unwanted files.

Menu-driven systems are the easiest to use, but just having a menu is no guarantee of understanding it.

Authors of database systems for large computers work hard to ensure recovery after a system failure. As the database is being updated, special transaction records are logged on disk or tape. In the event of a disaster, the disk files are reloaded from the prior night's backup, and the intervening transactions are played into a special recovery program that reconstructs the database up to the point of system failure. The only problem with this system is that the recovery program often does not work when the time comes. A similar error-recovery feature has been implemented in one microcomputer database system, where it operates more smoothly than most recovery schemes on large computer systems.

•*Documentation and support:* Buyers of expensive database management systems for large computers are expected to send their staffs to long training courses. As a microcomputer owner, though, you probably have neither a staff nor time for a two-week trip to a distant city. To operate your database system you rely on the documentation provided by the developer and the support of your dealer. The ideal documentation manual should offer both a tutorial that leads you through the system one step at a time and a reference section organized by command or function.

As you may have noticed, mail-order prices on database management software are typically lower than local dealers' prices. Mail order is fine for experienced users who may not need the support a dealer offers. As with all mail-order purchases, you should be sure to obtain sufficient information from the software publisher before you buy. Novices, however, will appreciate the expertise of a dealer. If you pay a dealer full list price to guarantee this support, make sure your dealer thoroughly understands the deal. You may also find recent books on database packages and dealer-offered courses to be helpful.

Desirable Features

Here's an outline of desirable features that you can use as a checklist in evaluating any database management software you might consider:

•*Multiple files:* Imagine yourself using a file management system that handles only one file at a time. Suppose you have set up a contact list and a product list as independent files, but now you need a report showing customer names together with product names. With your single-file system keyed to product number, there is no way of matching customers with products. The only alternative is a multiple-file system that will let you process two or more files together.

A file management system may be a multifile system, but many are single-file systems and don't really qualify as database management systems at all unless they have other redeeming features. Relational systems are by definition multifile systems. The file concept does not even apply to network/hierarchical systems, but they do have many of the properties of multifile systems. Complex turnkey software packages can be developed only on multifile systems with programming-language interfaces.

•*Full-screen editing:* Because microcomputers were invented before the video terminal became popular, early software was designed for the Teletype, the standard input/output device at the time. In addition, software transported from larger computers was written for 80-column punched cards. This anachronistic situation continued for a long time, and only recently has it become standard for software to use cursor addressing to display characters anywhere on the screen. Word-processing programs and electronic spreadsheets are prime examples of systems that permit the programmer to use the display screen as an artist uses a canvas.

Imagine for a moment the prospect of entering data without full-screen editing. If you are using an old-fashioned program to enter name and address data, the computer asks you for the last name, then scrolls to the next line, asks you for the first name, and continues scrolling and asking until the record is finished. The entire record is then displayed on the screen, each field with an identifying number next to it. You may now change any field by keying in its number. Each time you make a change, the new information is dis-

played on the entire screen.

Full-screen editing, on the other hand, shows you a screen with a series of blanks labeled with descriptive tags corresponding to field names. You move freely among the fields by using special cursor-control keys. After filling a screen with data, you use another key to release the record and start a new one. A display-format program controls positioning and validates the entered data. This editing method, patterned after the data-entry machines that replaced keypunches, is fast and efficient—most database-system authors have adopted it in some form.

One problem with full-screen editing is that video terminals address the cursor in different ways. Authors take special pains to allow for each terminal's idiosyncrasies, and they must provide configuration programs to go with their systems. Such a program usually has a menu of standard terminals, and you are invited to choose yours. An application that uses the full-screen editing capabilities of a Televideo terminal, for instance, would work on an ADM 3-A because the database program would perform the necessary translation. One problem with full-screen editing is that it doesn't work well if your system incorporates a slow modem.

Database packages typically use one of two types of screen editing. One type identifies each field by a number and requires that you key in that number to change the field. This is tedious, but it eliminates most errors because control-key sequences (using the CTRL key as an alternate shift key) are not required. The second type, which involves moving the cursor, is faster than the numbered-field method but requires more skill of the operator. Sometimes the terminal's arrow keys move the cursor, but often control-key sequences are necessary.

Whatever type of editing is used, a program that controls data entry makes data integrity less of a problem. The operator is simply not able to enter alphabetic characters into a numeric field.

•*Display-format generation:* The display format is what you see when you begin to enter or change data for a given database record and consists of the descriptive tags and blank spaces. Some systems lay out the display for you while others let you lay it out by using a kind of programming language. The latter method assumes that you have sketched the screen on graph paper to determine which rows and columns you will use.

A more convenient method lets you design the display format by "sketching" with the cursor. You can type in your tags directly, but you must somehow link the blank spaces you've positioned with the database fields they represent. A good format generator should let you use graphics, reverse video, and highlighting and should also permit the range of insert and delete functions common to word processors.

•*Password security:* Suppose you have set up an integrated accounting system with your database software. Let's say that the two tasks that consume most of your time are accounts payable and payroll and that you have two data-entry employees—the accounts payable clerk and the payroll clerk. Keeping the payroll clerk from knowing how much employees are paid would be virtually impossible, and the clerk might even be able to update pay rates. But because pay rates are confidential, you don't want the accounts payable clerk to see them, let alone update them. The pre-database solution to the security problem was to keep all the accounts payable programs separate from the payroll programs. The main payroll program would have some built-in logic to admit only those typing in a certain password—a crude but effective technique. If you have a database system with a programming-language interface, you can do the same thing, but you must program all the password logic yourself.

Simplified Employee File

Field	Access	Update
Employee number	0	2
Social security number	1	2
Employee name	0	2
Address	0	1
Date of birth	1	2
Date of employment	1	2
Pay rate	2	3

Password Dictionary

User	Access	Update	Password
All employees	0	0	FISHING
Personnel clerk	1	1	MOTHER
Payroll clerk	2	2	4300
Personnel manager	3	3	POWER

A password scheme for a large database system.

This sort of exclusive access does to some extent defeat the purpose of a database, though. After all, the point is to give an employee who needs to work with the stored data access to it. Rather than totally denying access to sensitive data, we need a system that grants access selectively.

Look at the example in the table above to see how authors of software for large systems have approached the problem. The numbers under Access and Update are security codes—0 designates the lowest security and 3 the highest. If you are a personnel clerk and can remember your password (MOTHER), you can use your access code of 1 to look at all fields with your security level or lower, which includes everything except Pay Rate. Your update code of 1 allows you to change only the Address field (if an employee moves, for example). The personnel manager is the only one who can update the Pay Rate field.

If you have made this sort of big effort to protect the Pay Rate field, be sure your system does not permit unauthorized people to make commands such as "list all employees in order by pay rate." Not only data

values themselves but also the relationships among them are subject to security.

All this password capability should be integral to the system. Security levels for fields are entered in the data dictionary along with field length, data type, and so on. Passwords are entered in a special section of the dictionary with the understanding that it takes a special high-security code to access and modify them. As databases move into the growing multiuser realm, passwords will become all the more necessary.

•*Multiuser capability:* To have a multiuser database system, you must have a multiterminal computer system with a multiuser operating system. But as you may have noticed, the multiuser microcomputer world is in a state of rapid development. Because the early 8-bit multiuser systems did not work very well, many buyers were disappointed. Now the industry is switching to networks of 8-bit computers or 16-bit multiuser computers. Both of these approaches have advantages and disadvantages, and each is best suited to different situations. All this makes life difficult for database-system authors, who would really like one standard operating environment such as they have enjoyed with CP/M.

File management and relational systems are suitable for people who are not computer professionals.

Most existing database systems will operate either in a CP/M multicomputer network or with MP/M, the 8-bit multiuser CP/M. If you have two users with two totally separate software systems, you're home free: you have two copies of the system and two sets of files on different parts of the disk, and neither user knows the other one is there. On a larger scale, you could assign certain files to be accessed by several users. If you had a database of community service agencies, for instance, you could assemble a city-wide network of inquiry terminals. All of these terminals would be connected to the master database and share the information kept on a common disk. The only problem is that with most multiuser systems you have to shut down the network to update the database.

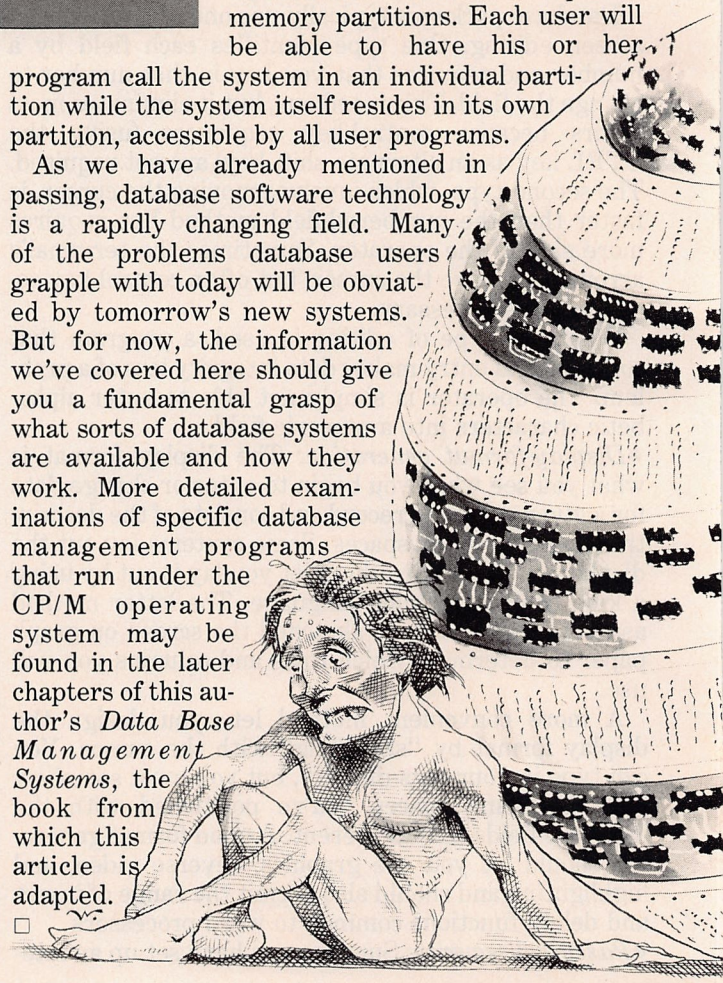
Ideally, a system should allow simultaneous updating and accessing of the database, but this is easier said than done. For example, say two people are trying to update information for part number 3250. Sharon, at her terminal, keys in the part number and watches the description and price appear on her screen. When she pauses for a phone call, Steve, at another terminal, brings up the same part and sees the same description and price. Sharon changes the price about the same time that Steve makes a slight change in the description. When Sharon finishes with 3250 and moves to the next part, the old description and new price she has inserted go back to disk. Just after that, Steve finishes and his new description goes to disk with the old price he has not touched. Sharon's price change has been erased!

The solution to this problem is the record lock, which means that the program locks out part 3250 the instant Sharon brings it up on her screen. If Steve wants to update the part, the program makes him wait until Sharon is completely finished before he can access the record or change it in any way.

There are two kinds of record-locking techniques: passive and active. Passive locking is usually automatic in multiuser systems. When a record is being accessed by one user, it may be read but not written to by other users. Active locking prevents another user from writing to *or* reading a record. It is switched on and off by specific commands and incidentally provides a sort of security system.

Authors of multiuser packages must produce some of the most complex programming imaginable. Multiuser code must be reentrant, meaning that all database users execute the same copy of the program. In this way, a multiprogramming environment usually becomes divided into a number of separate memory partitions. Each user will be able to have his or her program call the system in an individual partition while the system itself resides in its own partition, accessible by all user programs.

As we have already mentioned in passing, database software technology is a rapidly changing field. Many of the problems database users grapple with today will be obviated by tomorrow's new systems. But for now, the information we've covered here should give you a fundamental grasp of what sorts of database systems are available and how they work. More detailed examinations of specific database management programs that run under the CP/M operating system may be found in the later chapters of this author's *Data Base Management Systems*, the book from which this article is adapted. □



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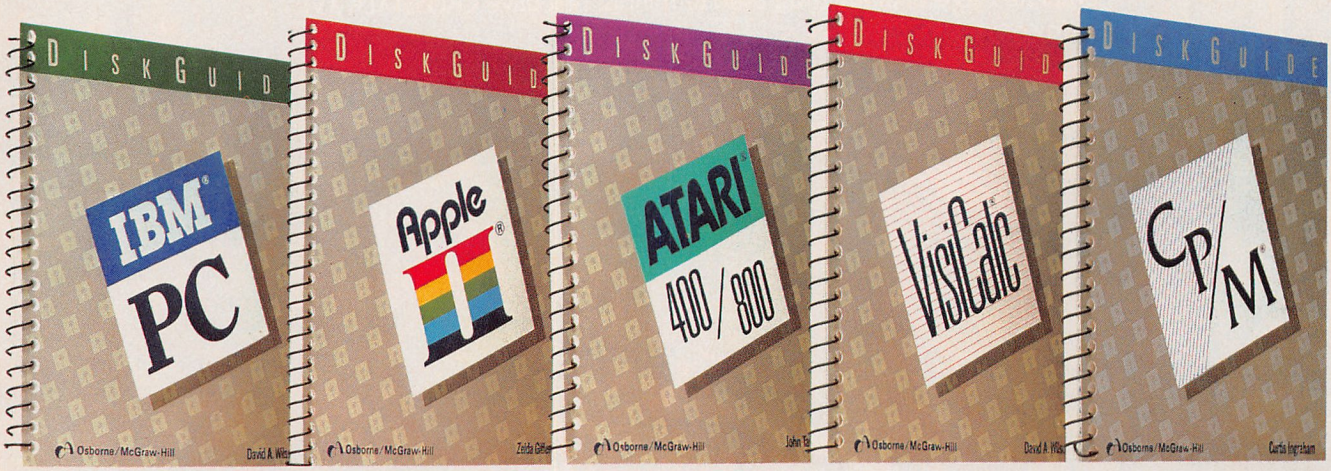

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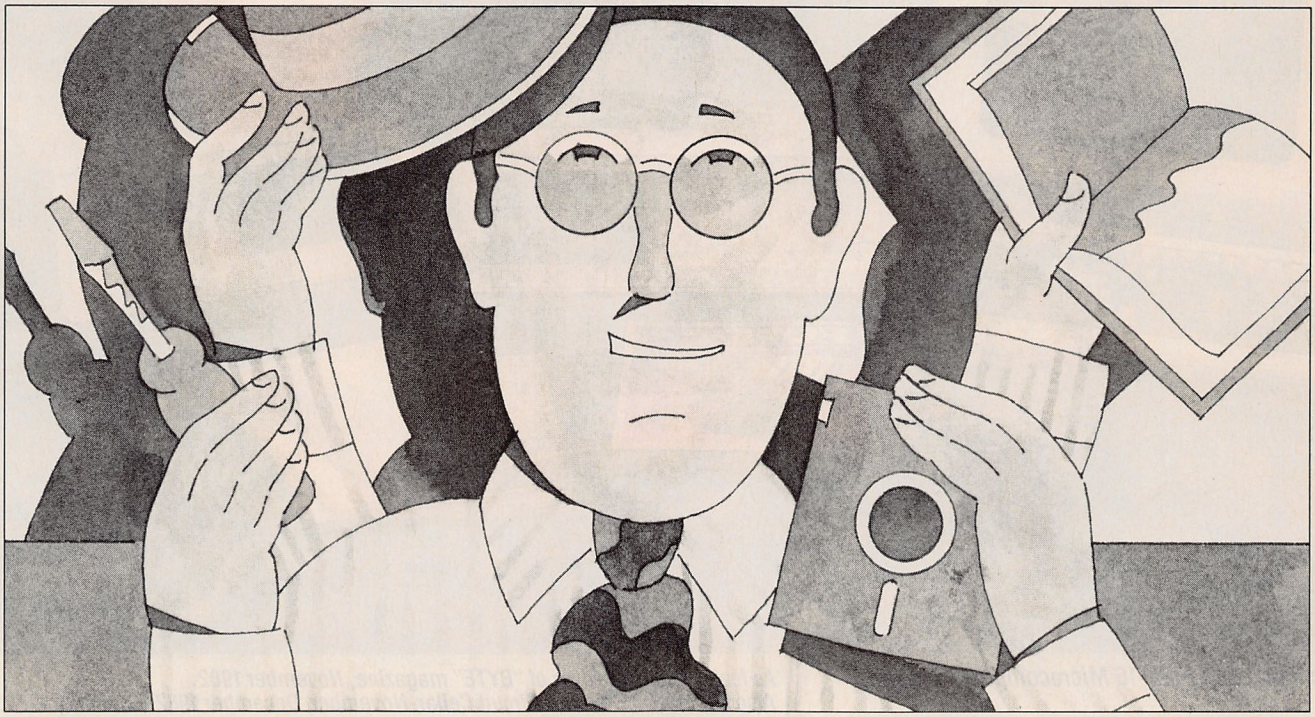

Sympathy for the Salesperson

The person who holds your hand has some pretty rugged days

by Stan Brin

I'm a computer salesman and consultant who isn't exactly drowning in customer respect. I want you to know from the outset, however, that this isn't going to be a tale of self-pity a la Rodney Dangerfield. Most of all, I want to dispel the silly notion that computer salespeople are making 600 percent markups on every item in their stores. Yes, America—I drive a 10-year-old Chevelle, not a Porsche.

You're likely to run into a few shysters in this business, but there were quick-buck artists in the steel business in the 1880s and assorted hustlers in the early days of the automobile industry too. The microcomputer business is a bit short on regulation, just like those enterprises of yore. Still, I adamantly maintain that most computer salespeople are honest men and women who sincerely believe in the products they're selling.

Some journalists covering the computer field are oblivious to the fact that there are thousands of boorish customers out there whose intent is to rob honest salespeople of their most valuable commodity: time. Here's a good example.

At least once a week I get a visit from the eminent Dr. Rajiv Pandit (not his real name), proud owner of a B.A., M.A., and Ph.D. Immaculately attired in an iridescent red suit with matching polka-dot tie and shirt, this Brahman scholar waltzes unannounced through our front door with the sole intent of interrupting whatever I happen to be doing.

On rare occasions, Dr. Pandit actually has a fixable problem of some sort (invariably attributable to his abhorrence of following instructions). But usually he has nothing better to do than to bore me half to death with pointless high-tech observations. If I'm not there, or if I manage to closet myself out of sight, Dr. Pandit will do his best to bother some other salesperson.

It is Dr. Pandit's belief that in exchange for the privilege of selling him a $1795 Kaypro II my col-

Stan Brin is a California freelance writer, computer salesman, and president of Heritage Software.

Illustration by Patrick Blackwell

The Micromint MPX-16 Microcomputer System.

As featured on the cover of "BYTE" magazine, November 1982.
Also featured in Ciarcia's Circuit Cellar, November, December 1982 & January 1983.

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leagues and I are obliged to treat him like a rich uncle for the rest of our lives.

Another prospective customer, a screenwriter who shall remain nameless, asked me to remain at the office more than two hours after closing so that he and I could have a long and leisurely chat about his unique formatting constraints. It turned out that we stocked a CP/M program that solved his problem, and he left our store a happy man.

A few days later I received a call from this turkey. Feeling very proud of himself, he told me that he had bought a computer at a modest discount from another dealer and asked me to sell him a copy of the program we'd discussed.

Gee, I thought, 60 whole dollars—and 36 of them go to the software author and distributor. Whoopee! I asked this fellow why he didn't buy the program from his new dealer. He replied that the discounter didn't known much about computers and didn't know anything about the program in question. Therefore, he begged, would I please show him how to format his screenplays?

In other words, for a $24 profit margin I would have to treat him like Uncle Moneybags for the rest of my life.

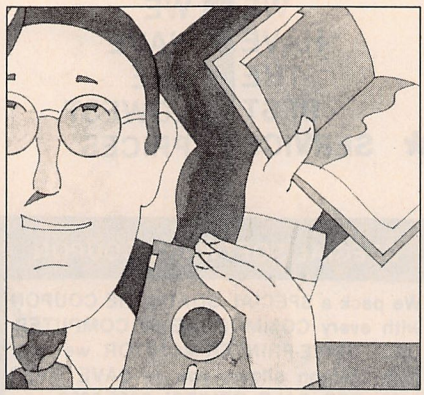
I'm afraid that my response was unprintable. As far as I know, the gentleman still doesn't know how to use his computer, and I hope he never does.

Of course the salesperson is obliged to show customers how to run the systems they're buying. And yes, the customer has a right to shop around for bargains. But customers don't have the right to keep dealers hog-tied for hours with aimless techie-talk—before *or* after a sale.

The customer must understand that the salesperson is also a human being with a living to make, a family to support, and a mortgage to pay. The salesperson might even be one of those odd individuals who like to take a lunch break now and then. Despite the high price tags some of our products carry, we're not paid as well as most municipal bus drivers, and the dealers we work for often struggle to meet their payrolls.

The retail computer business has become very competitive of late. High-volume, high-pressure discount stores owned and operated by inexperienced—sometimes even dishonest—people are sprouting up all over. The reputable dealer finds himself squeezed between the commitment to customer support and the realities of a cutthroat marketplace.

Microcomputer retailing is one of the most complicated businesses in the world. There are hundreds of computer manufacturers and hundreds more distributors of countless secondary products: software, modems, printers, buffers, and the like. No two of them interface in the same way.



There are plenty of boorish customers out there whose intent is to rob honest salespeople of their most precious commodity: time.

On top of this, no two customers ever have the same needs. A salesperson must know how to help theologians, foreign diplomats, and litter-box manufacturers (I've handled all three).

Each sale is a new beginning, yet some customers feel cheated unless the salesperson can immediately solve each problem and anticipate every conceivable need. No one gains from the resulting ill will (other than the manufacturers of antacid tablets).

Therefore, in the interest of saving both customer and salesperson a lot of irritation, I hereby propose a set of rules for customers to follow when dealing with computer salespeople:

- Write down what you want the computer to do for you.
- Don't expect miracles unless you're ready to pay for them.
- Find a good price, but don't expect something for nothing. Everything ultimately costs. If it seems too good to be true, it probably is.
- Do as you're told: follow instructions.
- Join a users group.
- Should anything go wrong, stay calm. Don't panic, don't scream. It won't help things.
- Don't drop cigar ashes on the dealer's carpet. He just might give you the reject he was about to send back to the factory.

My work *does* have its rewards. The computers I sell profoundly affect my customers. In few other trades could people expect to see their efforts so completely change the way people live and think.

There are also the good customers. These are the ones who lead users groups, solve problems themselves, and don't mind sharing their secrets. They listen, learn, and come up with applications the salesperson never would have imagined. Some even refer their friends, which helps the cause no end.

Today one of my good customers is coming to the office around noon to discuss a new word-processing application. He's the kind of guy who phones ahead for an appointment, and he's a good listener. After lunch, I intend to pick up the check. □

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(*with software savings applied)

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Complete Data Base	$89.00	$46.00
Electronic Spreadsheet	$89.00	$46.00
Accounting Pack	$69.00	$32.00
Total 5.2 Word Processor—Plus		
Tape	$69.00	$37.00
Disk	$79.95	$42.00
Total Text 2.6 Word Processor—		
Tape	$44.95	$26.00
Disk	$49.95	$26.00
Total Label 2.6	$24.95	$12.00
Disk	$29.95	$15.00
Quick Brown Fox Word Processor	$69.00	$40.00
Programmers Reference Guide	$20.05	$12.50
Programmers Helper	$69.00	$40.00
Basic Tutor	$29.95	$15.00
Typing Tutor	$29.95	$15.00
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Cash Flow Management	$89.00	$69.00
Sales Analysis	$89.00	$69.00
General Ledger	$89.00	$69.00

(*COUPON PRICE $59.00)

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Coleco's Adam

Matched components offer full features at a low price

by Michael J. Miller

The phrase "more for your money" seems particularly overused by advertisers of computer products—virtually every month we hear about a new computer that promises more power, more memory, and more features for a smaller investment. So it's not very surprising that a home computer system is now claiming to have set a new standard for maximum performance per dollar. What is surprising, though, is that this system does not come from one of the established microcomputer manufacturers such as Commodore, Atari, Texas Instruments, Apple, or even IBM (which at press time had not yet taken the wraps off its new home computer). Instead, the new system that offers so much for so little is manufactured by Coleco.

"Coleco?" you say. "Doesn't that company make just toys and video-game systems?" Not any more. Its new Adam computer system, scheduled to be available by the time you read this, comes with a full keyboard, 80K bytes of internal memory, a unique mass-storage system, two game controllers, several useful pieces of software, and a letter-quality printer as integral parts of the basic system. But Adam's most impressive feature is its list price: just $599.

System Components

Just as some stereo manufacturers offer systems comprising several different components, so Coleco has created Adam from three main components—the keyboard, the printer, and the memory console that includes the system's microprocessor, random-access memory (RAM), and high-speed tape drive.

The popular Z80A microprocessor powers Adam, addressing a standard 64K bytes of RAM and offering compatibility with the CP/M operating system. However, the computer also contains a separate processor for the video display that includes an additional 16K bytes of memory devoted solely to graphics, thus bringing the machine's internal memory up to a total of 80K bytes. According to Scott Coleman, director of marketing for Coleco's electronics products, another 64K bytes of RAM is available as an option, giving the computer 128K bytes of bank-switched memory.

Separate microprocessors oversee the keyboard and the printer, and all the components are linked together by a communications system Coleco calls Adamnet. While not a true network in the sense of being able to connect entirely separate microcomputers, this system allows the computer to do simple multitasking such as having the video processor put a drawing on the screen while the central microprocessor does some calculations in the background.

Built-in Peripherals

Instead of offering a printer and mass storage as the separate products they are in most home systems, Col-

Michael J. Miller is West Coast editor of *Popular Computing*.

eco has equipped Adam with a standard daisy-wheel printer and a high-speed tape drive. Al Kahn, Coleco senior vice-president, reports that the company developed both the drive and the printer, an approach that appears to have aided the company in lowering the system's cost.

The high-speed tape drive and the "digital data-pack" multitrack tapes it uses create a storage system comparable to many disk drives in speed and capacity while being much lower in cost, Kahn said. Each closed-loop, bidirectional tape is preformatted to hold 500K bytes of information (about 250 pages of text), and tape directories and data blocks are formatted in such a way as to ensure compatibility with a floppy-disk drive. The tape drive stores information sequentially, but its Fastransfer circuitry allows it to "think" in advance of where it is moving. The initial data is placed in the middle of the tape and subsequent files are added on either side. As a result, Adam's tape drive operates much faster than others used with microcomputers.

The tape drive can move at 100 inches per second as it searches for information and at 40 inches per second as it transfers information to the microprocessor. The transfer rate is 19.2K bits per second, which Coleco says is between eight and sixteen times faster than the typical home computer cassette drive.

Adam's Smartwriter printer runs at 120 words per minute (10 characters per second), the same speed as several other low-cost letter-quality printers developed by Coleco. The 80-column bidirectional printer comes with a 9½-inch carriage and uses standard Diablo daisy wheels, which means you may choose from many different type selections. While the printer comes with a friction feed, an optional tractor feed should be available early next year.

Word Processing for the Wise

Unlike other systems in which the word-processing package resides on a separate cartridge, tape, or disk, Adam has its Smartwriter word-processing program built into its read-only memory (ROM). To start using the program, you simply press the WP/Escape key. The program offers on-screen correction, deletion, and text searching, and it highlights the text to be moved or deleted. An "undo" key helps you retrieve material if you make an error or change your mind.

At a Glance

Name: Adam/Colecovision Family Computer System

Manufacturer
Coleco Industries Inc.
945 Asylum Ave.
Hartford, CT 06105
(203) 278-0280

Uses
Home computing including basic word processing and games

Standard Features
8-bit Z80A microprocessor, separate video processor, 80K bytes of RAM, 75-key detachable keyboard including word-processing and function keys, 500K-byte digital data-pack tape drive, two game controllers, 10 cps daisy-wheel letter-quality printer, software including Smartwriter word-processing program (built-in), Smartbasic and Buck Rogers—The Planet of Zoom (on data packs)

Base List Price
$599

Documentation
User manual, on-screen help menus

Options and Accessories
Adam system features also available as expansion module for Colecovision video-game system; further software and enhancements to be released

Although Adam's normal display has only 36 columns, several features in the Smartwriter word-processing program help you get around this limitation. These include a scrolling function that lets you move text back and forth to see different sections and a modeling function that simulates the 80-column format by displaying only the characters near the left and right margins. The word-processing program also serves as the editor for BASIC and will interface with future database and spreadsheet integrated software.

Adam's keyboard seems to have been designed with word processing in mind. It includes keys such as Insert, Delete, Move/Copy, and Store/Get that provide quick access to specific word-processing functions. In addition to 10 command keys (which also access some system functions), the keyboard includes arrow keys for controlling the cursor and six programmable function keys that can be defined by each program. In total, the keyboard has 75 keys.

Adam Plays Games

In addition to running programs on the data-pack tapes, Adam can also run all of the Colecovision game cartridges. The system includes two game controllers, and while these would be primarily used with games, one of them can be attached to the keyboard to control the cursor (as an alternative to using the arrow keys). Furthermore, the controller's keypad can be used for entering numeric data.

Adam comes with two data-pack tapes: the Smartbasic language and Buck Rogers—The Planet of Zoom, which is the first in a line of games more sophisticated than those available on ROM cartridges.

Because Smartbasic's source code is compatible with most Applesoft BASIC statements, most programs written in Applesoft BASIC will run on Adam. The only differences in the languages are in the handling of CALL, PEEK, and POKE commands, generally used by more sophisticated programmers.

CP/M and Company

Because it's based on the Z80A microprocessor, Adam is compatible with the popular CP/M operating system. Coleman noted that Coleco is working with third parties to convert many popular CP/M programs to the data-pack tapes by the end of the year. "We are trying our best to make sure the highest-quality soft-

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ware is available," he said. Although Coleco will be working with some software firms on the initial software release, the manufacturer will not attempt to prevent other firms from producing software in its format, he added.

The availability of third-party software should increase if Coleco introduces its planned expansion module, which has been scheduled for release by the end of the year. This module will contain an 80-column card and a floppy-disk drive and will retail for less than $300.

"Personally, I don't think CP/M is important to the success of the machine," Kahn said, noting that most CP/M software is for business applications. "But if people want those applications, they will be there."

Coleco is putting primary focus on its own integrated, interactive series of programs that will run on data packs, Kahn said. First to be released will be the Smartfiler database management program, scheduled for early next year. This program will be designed for managing financial spreadsheet analyses, personal planning diaries, and telephone directories.

Other programs now being developed include educational software such as a "homework helper" series, early-learning programs, and a version of Logo, and advanced home-budgeting and personal-finance programs are in the works too. Coleco also plans to introduce Z80 macroassemblers for programmers.

Adam has four expansion slots, three for peripheral cards and one for Coleco's upcoming expansion module. The slots can be used for such options as Coleco's steering wheel for its Turbo game, an 80-column card, or an adapter for Atari 2600 game cartridges. Coleco also plans to offer a $50 serial interface that will fit into one of the slots, Coleman said.

Another Version

In addition to the standard $599 computer system, Adam is also marketed as a "family computer system module" that plugs into the expansion interface of the firm's Colecovision video-game system. The module will add 64K bytes of RAM to the 16K bytes of graphics memory already in the game system and offer the other features of the Adam system. This version retails for about $400, Kahn said.

How was a video game company able to offer all this for such a competitive price? Coleco won't give out many secrets, but the answer seems to lie in a combination of mass-production efficiencies and some less expensive technology (such as the use of simpler motors).

Whatever the answer, the result is a positive one for the consumer, especially because other computer manufacturers will be forced to lower their prices to stay competitive. In the Garden of Eden of home computers, Adam will have to contend with Apples and many other competitors. But at present, Adam has the garden all to itself. □

Circle 109 on inquiry card.

The Pied Piper

But will it attract a huge following?

by Thom Hartmann

> And out of the houses the rats came tumbling.
> Great rats, small rats, lean rats, brawny rats,
> Brown rats, black rats, gray rats, tawny rats.
> Fathers, mothers, uncles, cousins,
> Cocking tails and pricking whiskers,
> Families by tens and dozens,
> Brothers, sisters, husbands, wives—
> Followed the Piper for their lives.
> —Robert Browning
> "The Pied Piper of Hamelin"

Ours being a mobile and fast-paced society, it's no surprise that the concept of portability in personal computers has caught on. In fact, it's taken off like a California brush fire. There are CP/M portables, IBM-compatible portables, flat-screen portables, hand-held portables, suitcase-sized portables, bubble-memory portables, and portables so heavy that only an NFL linebacker could move them. Portables are here, and the market is becoming both crowded and ruthless.

One of the more recent and certainly one of the most competitive entries into the fray is the Pied Piper I. Housed in an attractive box the size of an elongated briefcase and featuring a depth and weight about half that of most other portables, this new microcomputer had racked up $8 million in sales before the first pieces were shipped out the door—a powerful indication of the extent of the portable computer market.

The Pied Piper I— A portable computer with some new twists

Most portable computers on the market fall into one of four categories:

- Z80-based Osborne improvements (including the new Osborne Executives) running CP/M with built-in disk drives, 8-bit logic systems, and typically 64K bytes of random-access memory (RAM): the Kaypro II, Attache, Electric Briefcase, Escort, M6000P, Zita, and Zorba
- IBM-compatibles with 16-bit processors, disk drives, and huge RAM: the Compaq, Hyperion, Corona Portable, and Dot
- Truly portable portables that offer little or no mass storage: the Radio Shack Model 100, the Epson HX-20, and the Hewlett-Packard 75C.
- Specialty systems designed to be used as parts of larger systems (such as the luxurious and expensive Grid Compass) or as communications terminals rather than as full-fledged computers

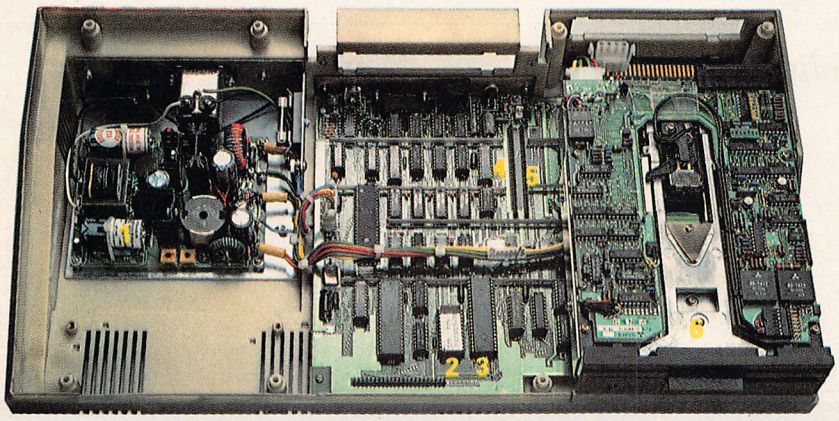
While this is by no means a comprehensive overview of the portable market, it does allow us to identify the Pied Piper as a member of the first category.

These computers, using CP/M operating systems, Z80 processors, and a wide variety of 5¼-inch

Thom Hartmann is a freelance writer living in Plymouth, New Hampshire.

Photographs by Bill Buckley

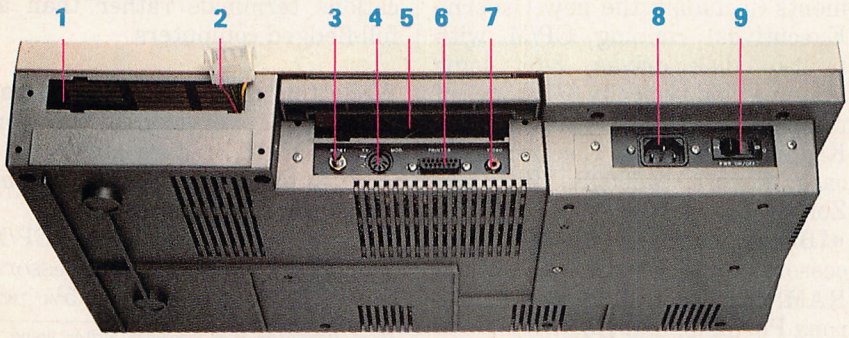
Inside:



1 60-watt switching power supply feeds computer and disk drive. Optional hard-disk drive comes with its own power supply.
2 2716 16K-byte system read-only memory (ROM).
3 Z80A microprocessor chip.
4 40-pin male connector for serial board.
5 40-pin male connector for liquid-crystal display (LCD). This display is not yet available.
6 800K-byte floppy-disk drive. With Perfect Writer, Perfect Speller, CP/M, and various utilities on one disk, you still have about 500K bytes of space left for text. Second drive can be plugged in but will not fit inside computer case.

Outside:

1 Cable-access slot for second disk drive.
2 When this cover is removed, a card-edge connector for the STD bus is exposed.
3 Reset switch.
4 TV modulator jack allows connection of the unit to any black-and-white or color TV set.
5 This space is for mounting two independent RS-232C serial ports or one RS-232C serial port and a direct-connect modem jack.
6 Parallel printer port—to conserve space, STM used non-Centronics port but kept Centronics signal configuration. A special adapter cable connects unit to a Centronics-interface printer.
7 Standard video jack for connecting monitor.
8 Power-cable socket.
9 On/off switch.



floppy-disk formats, are called portable only because of the public-relations acumen of one Adam Osborne. Actually, they should euphemistically be considered transportable. Only a tried-and-true masochist would attempt to bring along the huge, heavy battery packs that would actually allow balancing one of these machines on a lap and happily typing away during, for instance, a long plane ride. But while the Pied Piper belongs to this family of transportable computers, its manufacturer, STM Electronics, has managed to save and improve on some of the better aspects of its sisters while rejecting the worst.

As already suggested, the first complaint about most transportables is that they're brutally heavy, averaging around 25 pounds. But the Pied Piper neatly escapes this fault by tipping the scales at a mere 13 pounds. Also, most transportables have at best a mediocre disk capacity, averaging between 100 and 200K bytes. (While some are much better, they are much more expensive than the average $1800 price.) The Pied Piper beats its competition on this score too, offering 800K bytes of storage on a single disk.

The benefits of the Z80 family of transportables usually include low price, bundled software thrown in at no extra cost, and the wide range of applications programs for the CP/M operating system. The Pied Piper makes it on all three of these counts with room to spare. Its $1299 price is one of the lowest around. The applications packages bundled with the system—Perfect Writer, Perfect Speller, Perfect Calc, Perfect Filer, and a communications system—are all among the best. And, of course, CP/M is CP/M wherever it's found.

All of these advantages of the Pied Piper are only one side of the story, though. On the other side we find some offsetting drawbacks. The computer comes with no monitor and only one disk drive, and I feel that the few quirks I dis-

covered while taking the preproduction Pied Piper for a test spin seriously detract from many of its price/performance benefits.

Using the Pied Piper

All the software listed above came on a single disk, but with the enormous 800K-byte capacity of the built-in drive, you still have 300K bytes of storage on the disk for that great American novel you're writing. By inserting the disk and executing three simple commands, you're into the first screen of Perfect Writer, one of the friendliest word-processing programs around.

The program disk also contains a complete set of lessons on how to use the software. When you bring up Perfect Writer on the screen, you'll be asked if you want to open a file. Just specify LESSON1, and with friendly, understandable prompts you'll be guided smoothly through the ins and outs of efficient word processing.

Some Drawbacks

Two major drawbacks became apparent as soon as I began to use the Pied Piper, however. First, the keyboard has a stiff, "cheap" feel—not at all like a typewriter—that took some getting used to. Also, on the prototype I used, the backspace key got stuck nearly every time I pressed it, causing the cursor to go racing off like a backward Pac-Man, gobbling up all the text I'd written before that point. (A call to STM Electronics in California brought the assurance that this problem wouldn't show up on the production models. The company will use a different keyboard altogether, according to Henry Him, the customer support manager.)

Also, the Pied Piper lacks a buffer between the keyboard and the computer. This means that a fast typist can easily outdistance the computer, causing characters to be lost. The absence of a keyboard (or "type-ahead") buffer, which is merely a small bit of memory that accepts input from the keyboard at whatever speed you're typing and then feeds the characters into the computer at whatever rate they can be accepted, is a serious limitation for skilled typists.

The lack of a second disk drive can be both a blessing and a curse. It certainly keeps down the weight and the price (two of the machine's most attractive features), but it also means that backing up the 800K-byte disk can take forever.

As the Pied Piper has 64K bytes of RAM (less about 9K bytes for the operating system and the backup utility), only 55K bytes or so can be read off a disk and into memory at a time. To back up a disk with the single-drive Pied Piper, you first read 55K bytes from the program disk, then remove it and insert a blank formatted disk. The 55K-byte segment is then written to the blank disk. Remove that disk, reinsert the source disk, and repeat the process about a dozen times to back up an entire 800K-byte disk. Compound this confusion with the fact that each step requires the right keystroke at the right time, greatly increasing the chances of an error that would send you back to start all over again.

STM answers this concern with three possible solutions. The first, of course, is to simply become proficient at swapping disks. The second is to make backups at the time you create a file, giving the computer the Save or Copy command first to the disk in the drive and then inserting the backup disk and repeating the command. For most applications this would probably work, but because Perfect Writer uses the disk as "virtual" memory, constantly writing to and reading from disk rather than dimensioning a document in the computer's 64K bytes of RAM, a file's length is limited only by the available disk space. Therefore it is conceivable that a long document could use more than the 55K bytes free in RAM at any given time, sending you back to the flip-and-switch method.

The third option is to buy a second 800K-byte disk drive from STM. This configuration would only slightly affect the light weight of the Pied Piper and would make backing up easy, but it would demand an additional $500 investment, bringing the cost of the system up to that of the Kaypro II and its pals.

While on the subject of disk drives, it might be instructive to mention how the Pied Piper manages to get so much storage out of a single disk. The double-sided, double-density disk has 96 tracks per inch. This means that data is

At a Glance

Name: Pied Piper I

Manufacturer
STM Electronics Corp.
Suite 130
525 Middlefield Rd.
Menlo Park, CA 94025
(415) 326-6226

Uses
Personal and business computing demanding easy transportability

Standard Features
Hardware: 4-MHz Z80A microprocessor, 64K bytes of RAM, full ASCII keyboard, one double-sided, double-density 800K-byte floppy-disk drive, Centronics-compatible parallel printer port and cable, video output and cable to connect to 24-line by 80-column monitor; Software: CP/M operating system, Perfect Writer with tutorial disk, Perfect Speller, Perfect Filer, Perfect Calc, and communications utility

Base List Price
$1299

Typical System Price
Approximately $2050 for system including single disk drive, 2-line LCD display, modem, and carrying case

Documentation
Spiral-bound 72-page manual plus full documentation for Perfect software series

Options and Accessories
Second disk drive ($500), 300-bps modem ($200), dual RS-232C ports ($149), 10-megabyte hard-disk drive ($2000), 2-line by 80-character LCD display ($500), carrying case ($49), dBASE II, Wordstar/Mailmerge, Supercalc, MBASIC

Programming

dBASE II™ $398

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XLT 86		150	132

Utility/Comm/Graphics

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Grammatik	75	56
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Spellstar	250	165
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Series 8 - Inventory	750	515
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Series 8 - Sales Inv.	750	515
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Series 80 AR Videoterm †	400	275
Series 80 AP Videoterm †	400	275
Series 80 Inv. Videoterm †	400	275
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Series 9 - Peachcalc	375	258
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Sensible Speller †	125	94
Software Dimensions		
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Cardbox	245	177
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Fabs-BTREE File Access	195	146
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FMS 80-1	250	299
FMS 80-2	145	179
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dUTIL	99	59
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Infostar	495	327
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Sorting Facility (MSORT)™	195	151
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Accelerator		195
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SPP	200	150
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Pascal Z	450	375
Pascal Z & BZ	650	542
Microsoft ®		
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Fortran 80 †	195	146
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ACT 68	175	126
ACT 69	175	126
ACT 80	175	126
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Microstuf		
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Southwestern		
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Supersoft		
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PC Interface,Cable,Man.	300	239
Corvus Systems		
11MB Hard Disk	3295	2655
20MB Hard Disk	4295	3455
6MB Hard Disk	2295	1855
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written on tracks much thinner than those on a 320K-byte or 180K-byte disk, reducing the margin for error by several times. The slightest aberration in the alignment of the disk drive's head will cause weird data to come spilling forth, or even no data at all. Drives using such high density have the reputation for being finicky, and after three unsuccessful tries at formatting a brand-new disk, I understood why some pundits recommend avoiding them. The fourth try did work just fine, though, and I had no real trouble after that.

The Pied Piper's lack of a second disk drive is both a blessing and a curse. Not having one keeps the weight and price down, but it also means that backing up takes forever.

The Brains of the System

The Pied Piper uses a 4-MHz Zilog Z80A microprocessor, an 8-bit device that is only the second generation of the Z80 chips. While it is faster than the original Z80, which ran at 2 MHz and is standard on most machines, the Z80A is still two steps behind current technology.

More recently, Zilog came out with the Z80B, a 6-MHz version of the Z80A. But the latest and most advanced introduction from Zilog—one that could really make a portable sparkle—is the new Z800, which runs at an amazing 25 MHz, has multiply and divide operations built into the hardware, and offers an integral memory management unit (MMU) capable of addressing up to half a megabyte of RAM. It's a shame that STM couldn't have built the Pied Piper with this chip and more memory; it would've certainly made backing up disks easier and faster.

Documentation

The Pied Piper's manual is simple, small, and free of confusing concepts. The first few chapters are aimed at the first-time user and will probably be skipped by anybody who has ever been within a few feet of a microcomputer before. This section is very elementary but very useful for the first-timer.

The rest of the manual explains the computer's hardware and the utilities of the CP/M operating system. The text is coherent, systematic, indexed, and easy to read and use for reference. The entire manual is less than half an inch thick, and its 5- by 8-inch format and spiral binding make it easy to lay open beside the computer.

Each piece of the Perfect software series has its own manual, and while these are larger and more complex than the Pied Piper's, they're still straightforward and don't assume computer expertise on the part of the user. Perfect Writer is a star in its own right, and the rest of the programs are certainly competitive with others on the market. STM has made a wise decision in choosing this software for its system.

System Compatibility

Because Pied Piper disks hold so much data, they're written in a format that would look like Greek to an Osborne. No other computer can read from or write to a disk formatted for the Pied Piper. This brings up the question of compatibility among disk operating systems and applications software packages in general.

STM currently offers dBASE II, Wordstar, Mailmerge, Supercalc, and MBASIC for the Pied Piper (at extra cost, of course), and the company claims it will have hundreds of additional programs coming out by the time you read this. If the computer sells well, as it appears it will, we can assume that well-known software distributors and manufacturers will begin to offer their wares for the Pied Piper. Only time will tell.

One manufacturer already offering Pied Piper software is Softlock. In an ingenious scheme, you buy a demonstration disk for a low price (around $30). The demo works just like the real program except that it won't access files or disks. If you like the program, you call Softlock's 800 number, report your disk's serial number and your credit-card number to pay the full price for the software, and the company gives you a key number to unlock your software. You type in the key number and your demonstration disk becomes a full-fledged program disk. According to STM, Softlock will be a major supplier of Pied Piper software.

Another way to get software into the Pied Piper format is to connect the machine to another computer through an RS-232C port and download the program. Because the RS-232C port is a $146 option that wasn't included on the computer I reviewed, I wasn't able to check out how well this technique works.

Support and Service

For service, STM has made a wise choice in signing a national sales contract with Xerox, which has repair stations located all over the country. These stations offer free service during the first 90 days of the machine's life and will fix it for a fee thereafter. An optional one-year warranty ($180) is also available.

Although the Pied Piper's chips are socketed, it's a safe bet that most repair will consist of swapping boards rather than isolating the bad chip and replacing it. This approach can drive up repair costs, but it has become the general practice of the industry, particularly

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Optional Accessories

Several add-on products are available for the Pied Piper. The most intriguing of these is a 2-line by 80-character LCD (liquid-crystal display) unit that sells for $500. This would make the Pied Piper more transportable, but a traveling salesman, for instance, would probably rather use a home or hotel TV as a monitor than shell out the $500 for the LCD display or several hundred dollars for a monitor.

Speaking of monitors, STM is not planning to offer one. "There's such a wide variety of monitors on the market right now," says STM's Henry Him, "that we decided to let people choose the one they want and not get into the monitor business. The video output will serve either a monitor or TV, and that gives a good measure of versatility."

A second drive sells for $500 and connects to the Pied Piper with a cable accessible via a removable plate on the back of the machine. While it would certainly make backups easier, this drive will not fit in the computer's case.

Other hardware options include a 10-megabyte hard disk, which will be available later in the year at a cost of around $2000, and a 300-bit-per-second modem with its own built-in RS-232C interface, available for the paltry sum of $200. Because the modem has its own interface, you needn't buy the optional RS-232C interface ($146) to hook it up.

The Pied Piper comes with a plastic cover that folds down over the keyboard to protect it from damage while in transit. The disk drive, however, seems particularly vulnerable because it's on the bottom of the case when the unit is held by its built-in handle. To solve this problem, you can get an optional carrying case for the machine for $49.

Summary

With $1100 worth of "free" software and a $1300 price, the Pied Piper I represents one of the better buys on the market for the computer hobbyist or occasional business user who wants transportability. It's certainly convenient to use in varied locations, not weighing you down like a briefcase full of bricks, and it has a disk storage capacity that's truly extraordinary.

If the company could maintain this price while improving and buffering the keyboard, STM Electronics Corp.'s Pied Piper would be a fantastic value for anyone shopping in the low end of the microcomputer market. □

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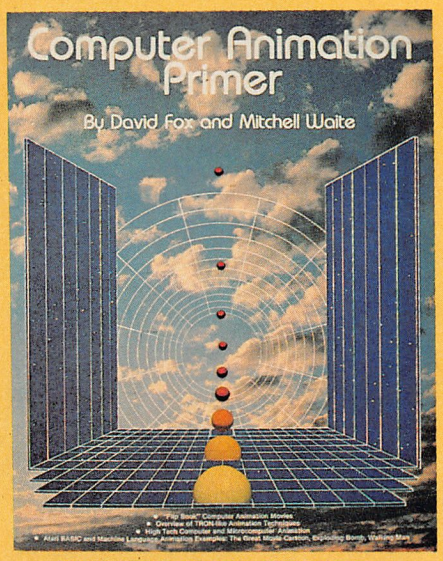

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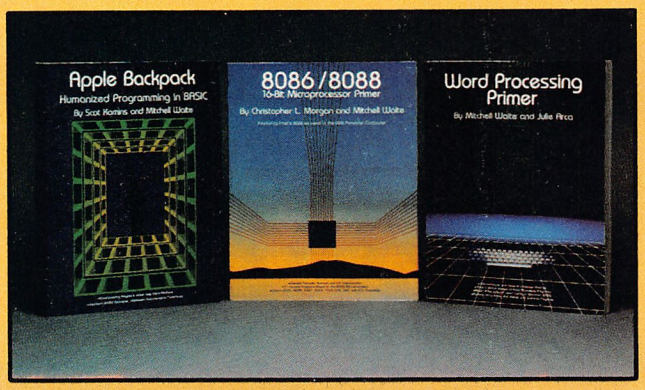

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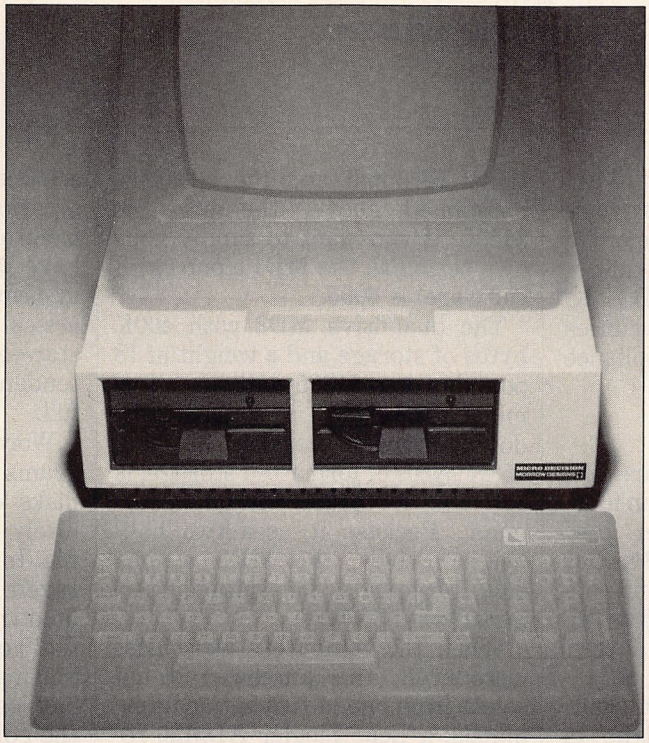
The Micro Decision

Morrow's desktop machine delights beginners and experts alike

by Bill Suydam

Just when flash and dash seem to be the only way to sell a new microcomputer—unless, of course, the new machine happens to be an IBM-compatible portable—George Morrow has come along to prove that a blend of bundled software, low price, and the sort of commonsense reliability that only an experienced hardware manufacturer can provide will still push machines out the showroom door.

Since 1976, George Morrow has been manufacturing cards and peripherals for S-100-bus computers—a demanding and competitive market where sound engineering and reliability are essential to survival and frills are secondary. Morrow recently turned his attention to the mass market for personal computers and set out to manufacture an "appliance" computer—a machine so simple and reliable that the complete novice can be comfortable with it.



The MD2 accepts any terminal. Shown here is the Freedom 100.

The Micro Decision series is the result of Morrow's efforts. It is a tribute to his marketing and engineering savvy that these computers not only are friendly, reliable beginners' machines but also have a great deal to offer the experienced computerist (Morrow's more customary audience). Each has a Z80 microprocessor and 64K bytes of random-access memory (RAM) and can compete feature-by-feature with some of today's best 8-bit personal computers.

The three systems Morrow currently offers vary in their disk storage capacities and prices, but not in their plug-in-and-go friendliness.

Under $2000

Because the $1000-to-$2000 price range in which Morrow's computers compete has become the most hotly contested segment of the market, a new computer vying for a place in this market needs more than a low price—well-chosen, easily used features are essential.

The Micro Decision series has such features in abundance. First of all, you get a full array of bundled applications software—a word processor, a spreadsheet package, a spelling checker, and two BASICs. (Personal Pearl, a database manager, will also be included by the time you read this.) Add to all that the Virtual Drive (a sort of phantom disk drive that lets you pretend you have an extra disk drive), the ability to read and write disks of other formats (Osborne 1, Xerox 820, and IBM PC), and a CP/M "front end" called Pilot that works with a series of Micro Menus and you've got a computer system ready to take on a multitude of personal or small-business

Bill Suydam is a senior technical editor for *Popular Computing*.

Photograph by Paul Avis

computing chores.

With Pilot and the Micro Menus, all the packaged software is nicely integrated. The result is a total *turnkey* system—computer jargon for a system that is ready to go as soon as you turn it on (literally at the turn of a key, in some cases). You can call any of the supplied applications programs from a menu that boots from the CP/M system disk. The system prompts you to change disks whenever appropriate.

Such friendliness makes this the perfect system for the first-time user who is still a bit shy about approaching a computer and having to learn a long list of commands. At the same time, the system is also very well suited to the experienced user wanting to do software development or word processing in a familiar CP/M environment without being plagued by the hardware and software bugs so common to new systems. Indeed, the inclusion of North Star-compatible BAZIC offers the programmer facilities rarely bundled into an appliance computer.

A File-Handling Benchmark

This Microsoft BASIC-80 program opens a file named TEST:1, prints 100 80-character strings of asterisks to the file, closes the file, destroys it, then repeats the above 99 times. Timing is from bell to bell.

```
10  ' BENCHMARK for file operations
20  ' as modified from Popular Computing, April 1982, p. 136
30  ' in Microsoft BASIC-80
40  '
50  CL$ = chr$(26) 'machine-dependent chr$
55  BELL$ = chr$(7)
60  '
65  PRINT BELL$;"START TIMING HERE"
70    FOR I = 1 TO 100
80      A$ = STRING$(80, "*")
150     OPEN "O",1,"TEST:1"
160     PRINT CL$
170     PRINT "STARTING LOOP "; I
180       FOR J = 1 TO 100
190         PRINT #1,A$:PRINT J
200       NEXT J
210     CLOSE 1
220     KILL "TEST:1"
230   NEXT I
240 PRINT BELL$;"END OF TEST"
250 END
```

Vive la Difference

All three computers share the same physical package and an identical board. The computer case itself is 16.7 inches wide, 5.3 inches high, and 11.3 inches deep and contains either one or two 5¼-inch floppy-disk drives. At the lowest end of the price range is the MD1—a single-drive system with 200K bytes of storage that weighs 14 pounds, 3 ounces. Included are two asynchronous serial RS-232C ports, one for the terminal and one for a printer or modem. (By the time you read this, a Centronics-compatible parallel port will be supplied on all models.) With an optional terminal and the software mentioned above, the price is $1590. If you want to supply your own terminal, the MD1 alone (with software) is $995.

The dual-drive MD2 with 400K bytes of storage and a weight of 18 pounds costs $1395 without a terminal. The MD3, a double-sided, double-density version offering 768K bytes of formatted storage, is available for $1990 without a terminal. Because it uses two half-height drives, the MD3 weighs only 14 pounds. The optional terminal costs $595.

When the computers were first introduced, the purchaser could select from one of two optional terminals: a Lear Siegler ADM20 repackaged under the Morrow logo or the Liberty Electronics Freedom 100. I have used both terminals and vastly prefer the Freedom 100. Sources at Morrow Designs say that the Freedom 100 will be replaced by the Liberty 50 from the same manufacturer. The only Freedom 100 features not found on the Liberty 50 are block-mode transmission (not normally used on this type of computer), built-in foreign character sets, and five of the ten special function keys (which are not presently used by the system's software anyway).

The Micro Decision I have reviewed is the dual-drive, single-sided MD2. Except for the number of disk drives and their capacity, everything I say here should apply to the MD1 and the MD3 as well.

The Virtual Drive

Although just about any personal computer manufacturer could have implemented the helpful feature Morrow calls Virtual Drive, only the Decision series offers it. The Virtual Drive is almost like an extra disk drive. Such a feature comes in handy for those occasions when you need to read from or write to another disk but have all disks tied up by the system. This sort of situation arises often when using Wordstar—especially if you have a tendency to let your disks get too full.

Wordstar is one of those programs that allow you to change disks only at certain times—definitely not when you are editing a file. In other words, if you have not saved the file you are editing (known as the present "working file") on the present working disk, you may not remove that disk without losing the unsaved version of the edited file. If the disk does not have room for a full copy of the latest version of the file, you will receive a Disk Full error message. If you cannot find room on any of the disks currently installed in the system, you are out of luck. You can't insert a different disk into the

current drive and save a file.

Virtual Drive to the rescue! Assuming you have had the foresight to keep a formatted disk handy, you can save the day by marking your file as a block of text and writing it to your third disk. The system will tell you that your left drive is being reassigned as drive C and will then ask you to swap disks. After you swap disks and hit Return, the file is recorded. The next time you attempt to use a Wordstar command that is not available in memory, the system will tell you that the left drive is being reassigned as drive A and ask you to hit Return after swapping disks again. In this straightforward way the text you were in danger of losing is saved. (Incidentally, the drive designations you can choose for the Virtual Drive are C, D, or E; you cannot use F, G, or any other letter designation. If you do, the system will bomb, aborting Wordstar, and you will find yourself staring at the CP/M system prompt, your file lost for good.)

When I first heard about the Virtual Drive, I was not that impressed. It sounded like a gimmick. After all, the Apple II allows you to copy a disk using only one disk drive, and Virtual Drive sounded like the same thing. I soon learned, though, that it's much more. By giving you easy access to an extra floppy disk, the Virtual Drive not only helps overcome the inherent limitations of a one- or two-drive system—it becomes essential if, say, you are editing text on a disk that is formatted for the IBM PC and you wish to save a backup copy on another disk formatted for the Micro Decision without all the inconvenience of exiting Wordstar, making the backup under CP/M, then getting back into Wordstar again. You simply write the desired block of text to a file on drive C as described above.

But perhaps even more important, Virtual Drive makes it possible to configure turnkey working disks for all the software supplied without the user ever learning commands like FORMAT or PIP—which brings us to the subject of how all that software is tied together.

The Software Connection

The most noticeable part of a Micro Decision system when you first boot it up—and easily the most significant aspect for the first-time computer user—is the Pilot/Micro Menus software. Frankly, as an experienced CP/M user I don't have time for these front-end packages. They take too long to load and really separate me from the work I want to do. I prefer a system that allows me to boot CP/M when I want CP/M or boot an applications program such as Wordstar directly from disk so I can begin working. With the Micro Decision, you have the best of both worlds.

The experienced user will probably want to erase Pilot and the Micro Menus from the working CP/M disk (not from the original) after all the other working disks have been set up. It is not a good idea to do this sooner because the system prompts you through the initial set-up process, including configuration for the proper terminal. The resulting working disks boot right up with the designated applications program.

The program that controls this auto-boot feature is AUTO.COM, which can be used to make any disk execute a .COM file or a CP/M transient command like DIR when it boots. I find it handy to have disks with numerous files (especially text files) boot up displaying their directories. If AUTO.COM is on the disk in the current logged drive, you can do this by typing the command AUTO DIR A: or AUTO A:STAT A:*.*, for example. You then press Return, and the disk is configured to boot up by running the appropriate directory program. This technique can also be used to display the contents of a file. AUTO TYPE A:MESSAGE would display a text file named MESSAGE.

While AUTO.COM can be used independently of Pilot, during the

The Sieve of Eratosthenes

This is a benchmark program in Microsoft BASIC-80. The version shown here will generate 1437 prime numbers; to display them, add line 165 PRINT PRIME. Lines 70 and 80 can be modified to generate more or fewer primes depending upon available memory.

```
10  ' Sieve of Eratosthenes, Prime Number Generator in Microsoft
20  ' BASIC-80
30  '
40  ' Adapted from BYTE, Sept. 1981, p. 188 (Jim Gilbreath)
50  '
60  '
70  SIZE = 5999
80  DIM FLAGS(6000)
85  PRINT CHR$(7)
90  PRINT "Only 1 iteration"
100 COUNT = 0
110     FOR I = 0 TO SIZE
120         FLAGS (I) = 1
130     NEXT I
140     FOR I = 0 TO SIZE
150         IF FLAGS(I) = 0 THEN 230
160             PRIME = I + I + 3
170             K = I + PRIME
180                 IF K > SIZE THEN 220
190                     FLAGS(K) = 0
200                     K = K + PRIME
210     GOTO 180
220 COUNT = COUNT + 1
230 NEXT I
240 PRINT COUNT; " PRIMES"
245 PRINT CHR$(7)
250 END
```

process of configuring working disks under the Pilot system its use is transparent. After selecting the Create Working Disks option from the main menu, you will see a screen explaining that you will be using the Virtual Drive. During the configuration process, drive A will be used for the CP/M system disk (created when you first start up the system), drive B will be used for the spare (working) disk, and drive C—the "phantom" drive, really the left drive—will be used for the distribution disk. The system prompts you each time the left drive is reassigned and tells you to switch disks.

If, for example, you are creating a working disk for BAZIC, the process would be as follows. From the Create Working Disks menu, you switch to drive C by inserting the BASIC distribution disk and pressing Return. Now you switch back to drive A. The system informs you that you do indeed have the correct distribution disk for BAZIC (a nice touch). It then formats the disk in drive B, after which it gives the command PIP B:=C:BAZ*.COM, which will copy all of the BAZIC files from the distribution disk to the working disk as soon as you exchange disks again. After the copying is done, you are prompted to make the final disk swap, and the system executes SYSGEN, configures the working disk for autoboot, and returns you to the working-disk menu. Pressing ESC will return you to the main menu.

The whole process is simpler to perform than it is to describe. You don't have to enter any commands—instead, you make two selections from a menu. You don't even have to be present during the process except to exchange disks. This system is an excellent example of making the computer friendly to the most unsophisticated user.

As you can see, the first-time user will find the Pilot system to be a painless introduction to CP/M. The CP/M tutorial shows you how to use the most common CP/M commands: DIR, ERA, REN, STAT, TYPE, PIP, and SYSGEN, as well as the most common CP/M control keys: ^C, ^P, ^S, and ^X. The commands can then be executed from the Micro Menus system or by exiting the system to CP/M. If you elect to remain within the front-end system, you are returned to the appropriate menu after running the CP/M command or applications software.

VARIANT2

This variation of file-handling benchmark in BASIC-80 was used to write TEST:1 file to disk in drive B, which was configured as Osborne 1 drive on the MD2.

```
10  ' BENCHMARK for file operations
20  ' as modified from Popular Computing, April 1982, p. 136
30  ' in Microsoft BASIC-80
40  '
45  ' NOTE: THIS VARIANT USES DRIVE B FOR WRITING TO DISK;
46  ' PREVIOUS VARIANT RAN FROM DRIVE B, WROTE TO DRIVE A
47  ' THIS ONE EXERCISES OSBORNE-CONFIGURED B DRIVE
48  '
50  CL$ = CHR$(26)
55  BELL$ = CHR$(7)
60  '
65  PRINT BELL$;"START TIMING HERE"
70    FOR I = 1 TO 100
80      A$ = STRING$(80, "*")
150     OPEN "O",1,"B:TEST.1"
160     PRINT CL$
170     PRINT "STARTING LOOP "; I
180       FOR J = 1 TO 100
190         PRINT #1,A$:PRINT J
200       NEXT J
210     CLOSE 1
220     KILL "B:TEST.1"
230   NEXT I
240 PRINT BELL$;"END OF TEST"
250 END
```

Nuts and Bolts

Each of the Micro Decisions is essentially a single-board computer with two RS-232C serial ports and a card-edge connector for expansion disk drives that is accessed through the rear panel. No expansion disk drives are available at present. The computer's box itself is made of sheet metal, and I have gotten away with resting my terminal on top of it.

The machine supports XON/XOFF and hardware protocols. Switches and jumpers on the main printed-circuit board control the configuration of the serial ports. The two ports come from the factory set for 1 start bit, 8 data bits, 2 stop bits, and no parity. The terminal port is set for 9600 bits per second (bps) with no handshaking. The printer port is set for 1200 bps with standard CTS (clear-to-send) handshaking. At present, it is necessary to remove ten screws and the cover of the machine to reconfigure the ports. This is partially offset by the fact that the optional terminals have second serial ports that are easily configured for printers or modems either by switches on the back or via software.

The newer boards, long since available by publication time, will support configuration via software—the average user should never have to remove the cover of his machine. Even on my machine, the latest software allows me to switch the printer port between 300 and 1200 bps using a program called SETBAUD.COM. I still have to use a special cable or remove the cover if I want to connect a modem directly to the computer.

The most obvious shortcoming of the machine I reviewed is the lack of a Centronics parallel port. Morrow has so far been very responsive to criticisms, however, and the Centronics port is included now at no extra cost.

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Benchmarks

One surprise was that while both Osborne and Morrow advertise 4-MHz Z80s, the Micro Decision ran appreciably faster than an Osborne 1. I had expected the MD2 to make faster disk accesses because it is a double-density machine and the disk read/write head travels a shorter distance to collect a given amount of data. Accordingly, I ran a disk-file manipulation benchmark (see "A File-Handling Benchmark" on page 156) and found that the MD2 was indeed faster, taking just over 12 minutes to execute the benchmark program that took the Osborne 1 almost 17 minutes.

The big surprise was that when executing the exact same MBASIC program (see "The Sieve of Eratosthenes" on page 157) *without* disk accesses, the MD2 took about two and a half minutes while the Osborne 1 took three minutes—20 percent longer. Actually, I had been tipped off by a Computerland technician that the Osborne 1 did not actually run at a full 4 MHz without wait states, and this comparison seems to prove it.

I then tried running a modification of the file-handling benchmark (see "Variant 2" on page 158) using an Osborne-formatted disk in drive B of the MD2 to receive the data. Predictably, the MD2 ran more slowly—taking 20 minutes and 15 seconds. If you plan to do extensive file handling on disks formatted for the Osborne 1, you will get quicker results using an Osborne, but under all other conditions the Micro Decision handles disk access more quickly.

Changing Formats

In case you are wondering how I ran an Osborne-formatted disk in drive B, I'll tell you how simple it was. Four programs are supplied with the system for reconfiguring drive B: MORROW.COM, OSB.COM, XEROX.COM, and IBM.COM. To reconfigure drive B for an Osborne disk, the command is OSB B:. The command for returning to the original configuration is MORROW B:.

There are limitations here, of course. I have found that running OSB.COM from Wordstar does not work. If you want to edit files on an Osborne disk, you must first configure drive B and then load Wordstar. Also, because drive A is not configurable as a "foreign" drive, you cannot write to an Osborne disk using the Virtual Drive. And while you can run programs written for the Osborne or the Xerox as long as they do not use any special features of the machines (such as graphics), you cannot run software written for the IBM PC (although you can read its ASCII files). If, however, you have ASCII files of programs written in high-level languages such as FORTH, C, or BASIC for the IBM PC and you are running an identical language on the Micro Decision, you should have no problem. But keep in mind that most commercial software for the PC does not fall into this category—you are, after all, running a different processor and a different operating system in the case of the IBM.

The Applications Software

I have already made comparisons with the Osborne 1, and if you are presently looking at the computers in this price range, you are probably wondering about the selections of applications software they offer. I have always considered the fine selection of free software one of the Osborne's primary selling points. How does the Micro Decision's software stack up against Osborne's? The answer is very well.

Wordstar, the word processor supplied by Morrow, is the industry standard. You might find another package you like better, but Wordstar is more than adequate. MBASIC—Microsoft BASIC-80—is also a sort of industry standard. It is both one of the most powerful and one of the best-supported BASICs. If you have MBASIC on your computer, you have at least satisfied your primary need for a computer language.

In addition to these two most useful programs, computers in the Decision series also come with the Correct-It spelling checker, the

At a Glance

Name: The Morrow Designs Micro Decision

Manufacturer
Morrow Designs
600 McCormick St.
San Leandro, CA 94577
(415) 430-1970

Uses
Any application appropriate for a CP/M machine: word processing, accounting, spreadsheet analysis, software development, etc.

Standard Features
Computer: 4-MHz Z80 microprocessor, 64K bytes of RAM, one or two 200K-byte single-sided 5¼-inch floppy-disk drives or two double-sided drives holding 768K bytes total (all capable of reading and writing Osborne, Xerox, and IBM-formatted disks as well as Morrow's), two RS-232C serial ports (one for terminal, one for modem or printer), Centronics parallel port, CP/M 2.2 operating system; Optional Terminal: 12-inch 80-column by 24-line high-resolution P-31 green-phosphor display, detachable keyboard with numeric keypad and keys for cursor control and special functions, extra RS-232C serial port; Software: CP/M 2.2, Wordstar, Logicalc spreadsheet package, Correct-It spelling checker, Microsoft BASIC-80, Personal Pearl database manager (MD2 and MD3 only), BAZIC, and Pilot (a CP/M front end)

Base List Price
$995 for MD1 (single double-density disk drive), $1395 for MD2 (dual double-density disk drives), $1990 for MD3 (dual double-sided, double-density disk drives), $595 for optional terminal

Documentation
Micro Decision Users Guide, BAZIC II Users Guide, and Correct-It Users Guide in one loose-leaf binder; CP/M 2.2 Manual (Digital Research); Wordstar, Mailmerge, Spellstar Manual, softcover (Morrow Designs); Microsoft BASIC-80 Manual, softcover (Morrow Designs)

Popular Options and Accessories
See system configurations under Base List Price

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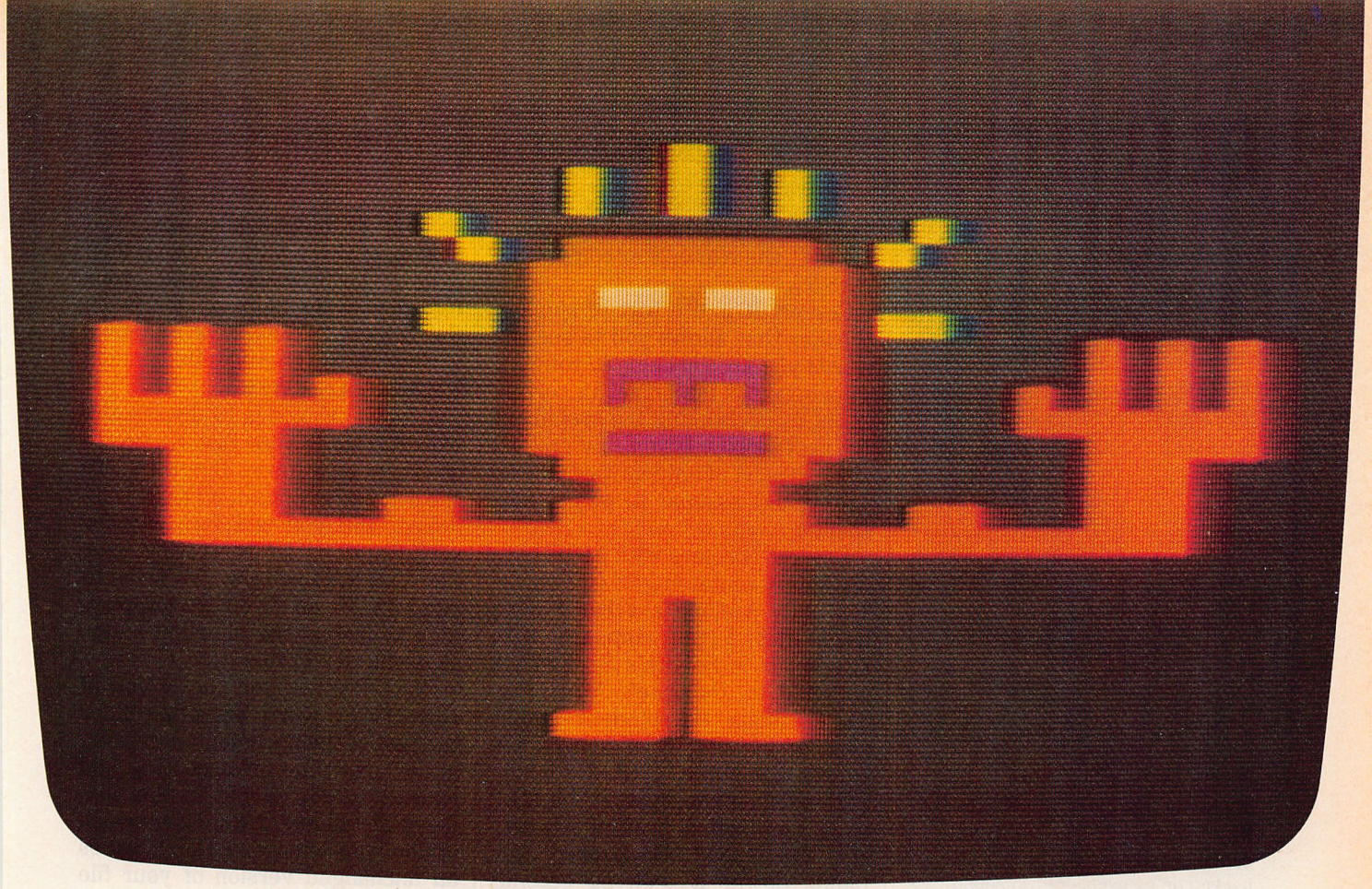

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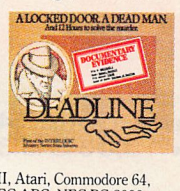

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Logicalc spreadsheet package, and BAZIC, the North Star-compatible BASIC.

Correct-It is the sort of spelling checker that allows you to see the words you are checking in context. This becomes important in certain cases, as in checking the spelling of RS in RS-232C. If you saw "rs" all alone in a list of unidentified words, you would assume it was a misspelling.

Correct-It comes with a 92K-byte dictionary containing 36,000 words. The only spelling checker I have used that I can compare with Correct-It is Sorcim's Spellguard, supplied in Osborne's Word-Pac. To eliminate the obvious unfairness of running Spellguard on a slower computer, I tried running both spelling checkers on the MD2 using an identical draft of this article. For speed, Spellguard won hands down: it took 32 seconds while Correct-It took about three times longer. However, Correct-It narrowed the file to 40 unknown words while Spellguard found 128. After carefully checking the word list—Correct-It's context-checking helped here—I found only one word was really misspelled: frst, a typo I had overlooked. So, while run time favored Spellguard, Correct-It spared me from checking about 88 correctly spelled words. Both spelling checkers found the misspelled word, however, and Spellguard has some nice features of its own.

Correct-It consists of four .COM files—CORRECT.COM, FIXUP.COM, LOOKUP.COM, and DICTEDIT.COM—as well as the supporting dictionary and index files. Each does about what you would expect. CORRECT.COM searches the file you specify for unrecognized words, first using the dictionary file DICT.BIN then an auxiliary dictionary called AUXDICT.TXT. If AUXDICT.TXT is not present on the currently logged disk, the program asks you if you wish to scan another auxiliary dictionary that you will have supplied. After it has searched the dictionaries, CORRECT tells you the number of unknown words. You now have three options other than exiting the program: correct your file, display the unknown words on the screen, or save the unknown words in a special file named FILENAME:BWD.

A logical choice is to display the words. This is your last chance to see them all at once. If you specify the correction option, FIXUP is invoked, and you will face another set of options for correcting your file. You will need the .BWD list to run FIXUP, so if you are not planning to correct the file right away, save the .BWD file.

FIXUP gives you the option of correcting a word, accepting it for the rest of the document, accepting it just one time, or accepting and learning it for saving in the auxiliary dictionary. No matter which option you choose, FIXUP saves an unchanged version of your file as a safety feature.

You can edit your auxiliary dictionaries (because they are ASCII text files), and you can merge them into one master auxiliary dictionary. You can also use DICTEDIT to modify the DICT.BIN master dictionary—the logical approach is to add your auxiliary dictionary to it occasionally.

LOOKUP is the last of Correct-It's utilities. It may be used automatically from FIXUP or on its own. It allows you to look up words in a spelling dictionary and shows you 10 to 20 of the words closest in spelling to the keyword you enter.

North Star-compatible BAZIC

Describing BAZIC could really be the subject of another review. It was originally designed to run programs written in North Star BASIC and execute them faster than North Star BASIC does. Unlike most CP/M BASICs, BAZIC is optimized for the Z80—it uses the full Z80 instruction set. There are many differences between BAZIC and MBASIC, and I will try to summarize some of them here.

One nice new feature in 3.03 BAZIC that might be of interest to

advanced programmers is that it supports direct function calls to CP/M, obviating the need to link or call assembly-language subroutines to accomplish the same purpose. The command format is

```
VARIABLE = CPMFN(<C ARGUMENT>
  [, <DE ARGUMENT>])
```

where the C argument is any CP/M function call number to be passed to the C register and the DE argument is any argument that should be passed to the DE register pair. When the function returns, VARIABLE will be set equal to the value in the HL register pair.

Like North Star BASIC, BAZIC has a different way of handling strings. Whereas most BASICs allow strings up to 255 characters in length and support arrays, BAZIC limits string length only to available memory but does not support string arrays explicitly; you have to grow your own. This is done by dimensioning a string to the size of the array (strings longer than 10 characters have to be dimensioned in BAZIC) then indexing into the string to find substrings corresponding to values of the array variables. If you were going to write a text editor in BASIC—not a project I particularly recommend—BAZIC would be a logical choice over MBASIC because the entire text file could be treated as a single string. You will also have to learn to live without the functions LEFT$, RIGHT$, and MID$ in BAZIC—the equivalent functions can be implemented, but they are formatted differently.

BAZIC's FOR-NEXT loops also differ from those found in some other BASICs. The NEXT control variable is incremented at the end of the loop; upon leaving a FOR-NEXT loop, the control value is one step greater than the limit value. Even IF-THEN evaluation is done differently. In BAZIC, if the IF statement is evaluated as false, execution skips one statement following the THEN statement and executes the next instruction on the same line (or the next line if there are no more statements on the IF-THEN line). In effect, you have an implied ELSE.

In keeping with its different methods of string handling, BAZIC also handles files somewhat differently from, say, MBASIC. First of all, a file must first be created with its size and type specified in advance. BAZIC program files are type .002 and data files are .003. If no type is specified, data (.003) is assumed. The file type can be specified by any integer from 0 to 127. BAZIC can open, read, and write to any type of file, including BAZIC and machine-language programs. BAZIC will write numbers, strings, or byte values to those files either sequentially or randomly. You can, if you wish, specify NOENDMARK at the end of a WRITE statement, which will abort the usual end-of-file marker.

In addition to this immense freedom in file handling (MBASIC simply cannot be used to manipulate some types of text and data files due to its data formatting), you have your choice of 8-, 10-, 12-, or 14-bit precision floating-point numbers. You choose by running the appropriate BAZIC: BAZIC08, BAZIC10, and so forth.

Logicalc

I found Logicalc very similar to Supercalc. I have always been annoyed by Supercalc's use of the slash character to initiate command mode because I quickly wear out the required finger. Logicalc is slightly more civilized: it uses the semicolon, which is a bit easier to reach. For example, to GOTO (cell) A2 in Logicalc, the sequence would be

```
; (command mode) G (GOTO) A2
```

I find this easier to execute than Supercalc's / = A2. The TAB key can also be used for the GOTO command. Admittedly, these differences seem trivial until you have worked on a spreadsheet for a few hours.

Logicalc also features centering of text within a cell in addition to flush left and flush right; Supercalc's omission of centered text always seemed to me to be a great oversight. A repetition function also makes cell formatting with symbols such as dashes and asterisks easier—to fill a cell with asterisks, first set the cursor at that cell, then execute the command /=*. This will fill the cell with asterisks all the way across, regardless of the cell's width. A page-formatting command is also included to control printing. It is also possible to specify a title for each page before you print it. And for those who are concerned about financial forecasting, Logicalc fully supports linear regression.

Conclusion

I am very pleased with the MD2. All the machine's features have performed flawlessly unless mentioned here, and it shows no signs of malfunction or overheating despite being left on literally from morning to midnight. The 80-column by 24-line 12-inch green phosphor display alone makes my Osborne much less pleasant to use, and as I have already noted, the MD2 is also faster.

Only in its user-configurable function keys does the Osborne 1 outshine the Micro Decision, which cannot offer such a convenience because it might be hooked up to any of a number of terminals. I suppose you could patch your CP/M to trap your terminal's function-key control codes and return the desired strings to your applications software, but that is beyond the capabilities of the average user. A better approach for the user not comfortable with assembly-language programming would be to buy a program like Smartkey (FBN Software, 1111 Sawmill Gulch Rd., Pebble Beach, CA 93953) that allows you to assign string values to any key on your terminal's keyboard. □

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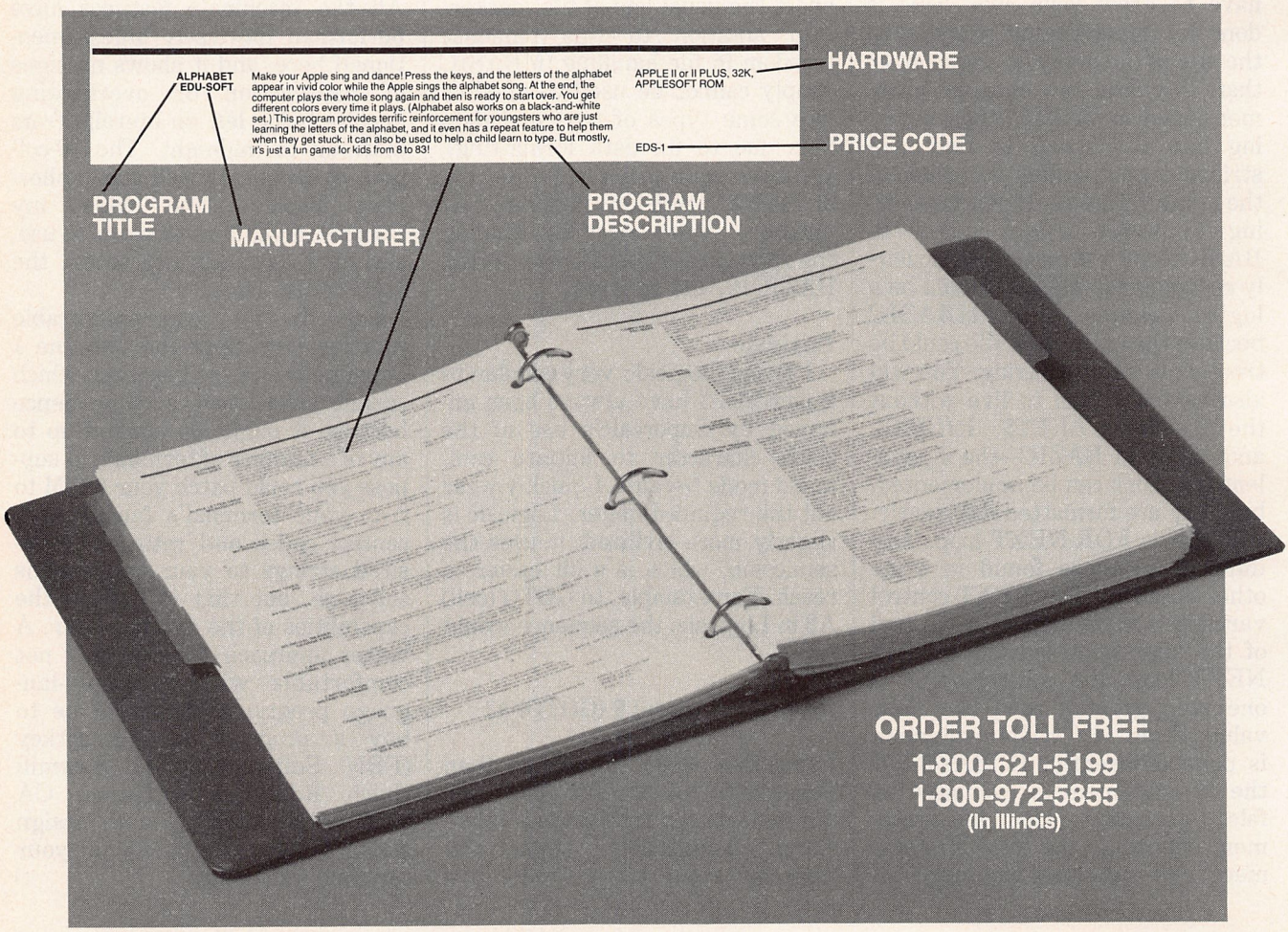

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RANDOM ACCESS

A wide-ranging look at ways to get more from your personal computer

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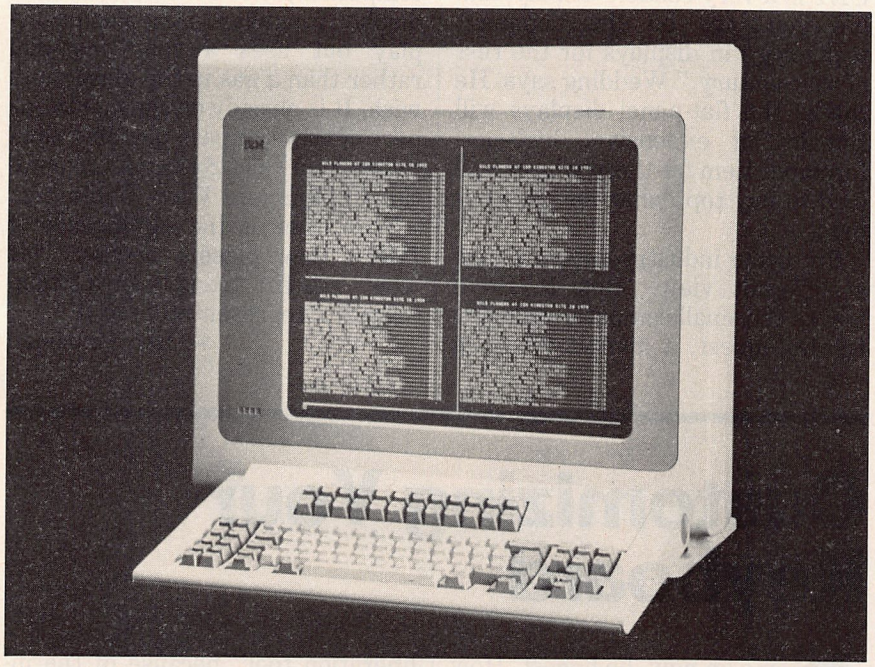

Slim-profile IBM plasma display can generate as many as 11,040 characters.

IBM's New Plasma Display

In the computer industry, when IBM sneezes, everyone else says "Gesundheit" and then speculates on what the new virus will mean. A case in point is the new IBM *plasma* computer display screen that has been stealing trade show after trade show since late last year. It's a futuristic, flat-panel display unit, only 3 inches thick, with a sharpness of resolution that rivals a photograph's. Because it's so clearly superior to conventional TV-like cathode-ray tube (CRT) displays, the new IBM display has inspired a spate of articles suggesting that the days of the CRT are numbered (assuming, that is, that the price of a plasma unit will come down from the stratosphere).

When you actually see the plasma display, you quickly understand what all the fuss is about. Although its slim profile is striking, its extremely high resolution is what really sets it apart. While a standard "high-resolution" CRT can display 2000 characters, the new IBM plasma unit can display as many as 11,040 characters. The reason for this excellent resolution is simple: it has more of the dots of light—called picture elements or *pixels*—that create the screen image. The plasma display boasts 737,280 pixels, far more than the 300,000 in a standard CRT.

As a further enhancement, the plasma display has none of the glare and flicker that can inflict eyestrain on the user of a conventional CRT. The pixels of a typical CRT are continually "refreshed" by a rapidly moving electron beam that scans the screen, sometimes giving the image a wavy quality. The plasma display's image is stable; the pixels emit a steady glow until they're turned off.

Here's how it works. Plasma (an ionized gas) is sandwiched between two glass plates, and on the inside of each plate is a network of tiny parallel wires that serve as conductors. There are 960 vertical conductors on the front plate and 768 horizontal conductors on the back plate. In this way the two sets of conductors form a grid, and each intersecting point is a pixel. When current is sent to one of these intersections, the neon-argon gas mixture between the plates is ex-

cited, producing a point of orange light. As long as the current continues to flow, the light continues to glow.

The IBM plasma display is currently available in two versions. One is a stripped-down model without cabinet or interface circuitry that is offered to other manufacturers (known in the trade as original equipment manufacturers or OEMs) who will do the final packaging. The official title of this component unit is the IBM 581 Plasma Display Subassembly. The other version is a top-of-the-line computer terminal called the IBM 3290 Information Panel. Designed for use with IBM mainframe computers, the 3290 Information Panel uses the 581 Plasma Display as one of its components.

Price Breakthrough

The good news about these new products is not the plasma technology itself—that has been around for more than a decade, with its biggest user being the military. Rather, the good news is the price breakthrough represented by IBM's new product. The company is selling the 581 subassembly for prices ranging from $3400 for a single unit down to $2040 per unit for orders of at least 2500. One OEM, Photonics Technology Inc. of Northwood, Ohio, will be configuring the 581 for use with the IBM Personal Computer. Donald K. Wedding, vice-president of marketing for Photonics, estimated that after his company adds a power supply, cabinet, and interface circuitry, a single display unit will cost about $4900. Following the IBM price scale, the individual cost would be lower for multiple orders, down to $2900 per unit for a minimum order of 2500.

Such prices don't seem in the bargain basement until you compare them with prices for the plasma display units that Photonics sells to the military. According to Wedding, the company has been building and selling a plasma display of similar size but higher performance for about $10,000.

Will Plasmas Replace CRTs?

But even with this price breakthrough, Wedding doesn't believe that plasma displays or other flat-panel technologies like liquid-crystal and electroluminescent displays will seriously challenge the CRT for many years. "Almost every month since 1950 there's been some article in some journal talking about how flat panels are going to conquer the CRT. Well, it's just not going to happen. The CRT is a very reliable display, and it's going to be the dominant technology in displays for the rest of this century," Wedding says. He thinks the flat-panel displays will remain an expensive, high-performance item for those who can afford to pay top dollar for the very best.

But some industry analysts take a different view. Alex B. Stein tracks the small computer industry for Dataquest, a market research firm in Cupertino, California. He thinks that flat-panel displays will capture 20 to 25 percent of the market by 1987. However, he believes that plasma displays will not be out in front. Instead, he expects that the real inroads will be made by liquid-crystal and electroluminescent displays.

Liquid-crystal displays have long been popular with calculator and watch manufacturers, and many researchers are looking for ways to make these displays large enough for computer screens. The other competitor, the electroluminescent display, is similar to the plasma display but uses a solid material rather than a gas in the glass sandwich. It is already on the market as part of the Compass portable computer from Grid Systems Corporation of Mountain View, California.

What then is the significance of IBM's new plasma display? "It won't set the trend," says Stein. "But it's representative of it."

—Dara Pearlman

Customizing Your Keyboard

Come on now, be honest. How many times have you had to leaf through your printer manual to find yet again the right code for boldface or underlining? And how many times have you wished you could get your hands on that distant programmer who decided to ignore your computer's convenient cursor-control keys and instead decreed that you use a combination of the control key and some letter to move the cursor?

You can solve these and a host of other problems with the help of a new kind of program that usually goes by the bland, vague name *keyboard enhancer*. After working with one myself for several weeks, I'm inclined to call it a "user-liberation tool" because of the increased control it gives me over my software. I feel like *I'm* in charge, not some unknown program designer who made all kinds of assumptions about what would be convenient, easy to remember, and user-friendly for me.

As is the case with many powerful ideas, the principle behind the keyboard enhancer is simple. The program allows you to change the way your computer interprets input from the keyboard—with a few simple commands you can change the meaning of a key. Suppose, for example, that your word-processing program doesn't recognize your keyboard's cursor-control keys and instead uses Control-X to

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move the cursor down a line. With a keyboard enhancer, you can make the word processor think it has received a Control-X every time you press your keyboard's down-arrow cursor-control key.

Saving Keystrokes

Not only can you change the character a key produces, you can also assign multiple characters to a single key. This means that you can store the code that tells your printer to produce boldface in the Control-B key combination, for example, and never have to refer to your printer's feature chart again. Similarly, you could store your name and address in the Control-N combination and save yourself a lot of repetitive typing.

David Rose is the author of Prokey, a keyboard enhancer for the IBM PC. He explains that the computer "shorthand" that allows one keystroke to produce many characters is an extension of the *macro*, a concept familiar to assembly-language programmers. A macro is a group of computer instructions with a single descriptive name. After defining the macro, a programmer can use the group of instructions in a program by simply writing the macro's name instead of recoding the instructions every time they're needed. The macro exploits one of the computer's major talents: its outstanding memory for picayune details. With a keyboard enhancer you can store a host of details that you don't care to remember in convenient pigeonholes referenced by keystrokes.

A word of caution is in order, however. Like any powerful tool, a keyboard enhancer can get you into trouble if you don't pay attention to what you're doing. I made a classic blooper when I was trying to use Prokey to automate the commands for changing typefaces on my Epson printer. I decided that the combination of the control key and the letter "I" would make a fine place to store the command that invokes the italics font. Then I noticed to my chagrin that every time I hit the tab key the command for italics appeared.

No, it wasn't a program bug. The Control-I combination and the tab key just happen to be identical twins—each sends the same signal to the computer's microprocessor (ASCII 009 to be precise). Whenever Prokey saw that signal, it thought I wanted the italics command. You can avoid such surprises if you consult an ASCII (American National Standard Code for Information Interchange) chart before you redefine your keys.

Where to Get One

If this discussion has intrigued you, you probably want to know where you can get a keyboard en-

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hancer. If you're in the market for a new computer, you might want to consider some of the models that have easily redefinable ("soft") keyboards. One such machine is the Victor 9000. Its KEYGEN utility allows you to assign as many as 32 characters to each key. In addition, its E-FONT program allows you to design your own characters. Unlike some of the stand-alone keyboard enhancers, the Victor 9000 will not allow you to change key assignments while you are running an applications program. After you design it in advance, your custom keyboard becomes part of the system when you turn the power on.

If you have an IBM PC, you're also in luck. There are at least two well-regarded keyboard enhancers for the PC: Prokey ($75) from Rosesoft (Suite 601, 4710 University Way NE, Seattle, WA 98105) and Keynote ($99.95) from Advanced Software Interface (Suite 260, 2655 Campus Dr., San Mateo, CA 94403). Prokey is a bit more powerful; it allows you to redefine more keys and it has some extra features that advanced users will enjoy. Keynote is slightly easier to use with its more extensive on-screen prompts, and it can be tailored to take up less memory. Prokey uses about 8K bytes of memory while Keynote can use anywhere from 1K to 64K bytes of memory. At the time of this writing, a new keyboard enhancer for the IBM PC is scheduled for release this year: Smartkey II ($89) from Heritage Software (2130 South Vermont Ave., Los Angeles, CA 90007).

If there's no keyboard enhancer that runs on your machine, don't despair. The popularity of the current programs will probably encourage software developers to create keyboard enhancers for other computers in the near future. And if you can get one for your computer, rejoice. You too can get the pleasant feeling that you're in charge of your computer.

—Dara Pearlman

Interfaces: Vital Links for Your Hardware

So you've done your homework and assembled a list of the computer hardware and software that will not only meet all of your business needs but also enliven your cocktail parties with the latest arcade-style games. Before you pop down to the computer store to plop down your check, though, consider one more thing: will those expensive components be able to talk to each other?

If all of the components come from the same manufacturer, you probably don't need to worry. But if you've picked and chosen from all the industry has to offer, you may save yourself a lot of grief by making sure (before you buy) that your Brand Z printer will indeed run with your Brand Y computer.

This may seem strange if you're new to the microcomputer marketplace and are used to electronic products such as stereo components that fit together with standard cables plugged into standard sockets. Unfortunately, the computer industry is only slowly adopting standards, and even the "standard" connectors or *interfaces* can have variations that might foil communications.

An interface works on two levels: hardware and software. On the hardware level a special circuit board or "card" translates the computer's native voltage levels and signal timing into a form that can be transmitted over a cable to a peripheral device. The peripheral also needs its version of the same kind of interface to decode the transmission into its own native electronic language. A hardware interface is often called a *port* because it provides a gateway to the central processing unit (CPU) that is the brain of the computer.

On the software level you need an appropriate "device driver." This is usually part of your computer's operating system, and it should allow you to do things like set the transmission rate of your modem or tell your printer when you want to use subscripts or double-space a document. A device driver can also be part of an applications program such as a word processor, which is why many programs need to be "installed" before they can run on your computer.

Over the years a number of official and de facto standards have emerged for the hardware part of the interface, but the software side is still pretty much wide open. The three most common hardware interfaces are the Centronics parallel interface, the RS-232C serial interface, and the IEEE-488 interface. Because compatibility begins with the hardware, let's look at each one in some detail.

Centronics Parallel Interface

The simplest way to connect a microcomputer to peripheral devices is with a *parallel* interface. It's simplest because the structure of the interface, with its eight parallel data lines, is very similar to the communication system or *bus* connecting the chips on the computer's main circuit board. Eight is the favored number because it takes eight electronic binary digits or *bits* to define one character or *byte*. The parallel interface has one main drawback—because of its limited signal strength it can send data for short distances only, generally no more than 10 feet. Nonetheless, it's a good choice for components that will sit close to each other.

A microcomputer printer is often equipped with a "Centronics" parallel interface, so named because it's modeled after the interface developed in the early 1970s by Centronics Data Computer Cor-

poration for its popular Series 100 printers. Manufacturers not wanting to mention a competitor's name may refer to the Centronics parallel interface as the "industry standard parallel interface."

If both your computer and printer are equipped with Centronics parallel interfaces, you're not likely to have problems on the hardware level with mismatched voltages or pins. But you could still encounter problems on the software level, and it's wise to insist on a demonstration to prove that your printer will work with your chosen software.

RS-232C Serial Interface

Serial data transmission has a venerable history that begins with the first dots and dashes of the telegraph system. It still dominates in the world of long-distance data transmission because it requires only one line instead of the eight usually used in parallel transmission. The bits of information line up in single file instead of traveling in groups of eight, and thus they have no trouble hitching a ride on the existing telephone network.

A serial interface takes the parallel signals from the computer and lines them up for serial transmission. The RS-232C standard established by the Electronic Industries Association (EIA) is the result of collaboration between the Bell System and computer equipment manufacturers who wanted a way of communicating between computer terminals and modems.

This standard is fine if you're using a terminal and a modem to talk to a distant computer, but because it is a recognized serial interface standard, RS-232C is also used to make serial connections that its designers never considered—and this leads to problems. For example, you can use RS-232C interfaces to connect a microcomputer to a printer. To maintain the standard, one device pretends to be the terminal and the other pretends to be the modem. If both of your devices are pretending to be at the same end of the modem-terminal line, you'll need a special cable to connect the two.

Even when your printer and computer are properly connected, you may find the printer forgets to print a character or even a whole line now and then. This happens when the printer's buffer or data storage area overflows and the computer keeps sending information that has nowhere to rest until the printer catches up. The RS-232C interface allows this to happen because it thinks the data is going out over a phone line—it doesn't know that a relatively slow print head is trying to keep up with the data stream. Some manufacturers handle this problem by modifying the standard to allow the printer to signal when its buffer is full, but because such a

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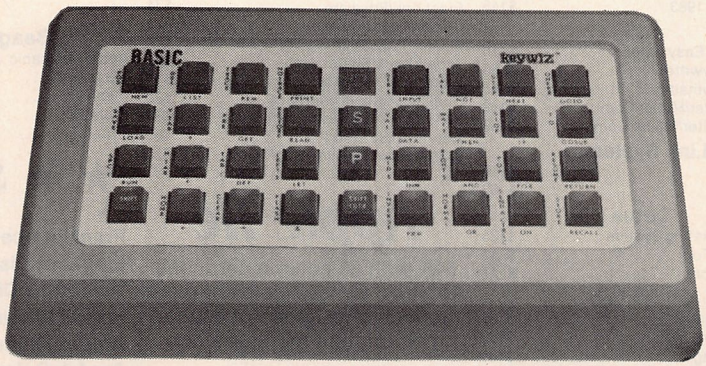

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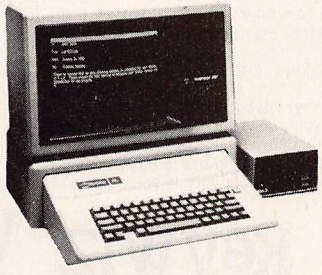

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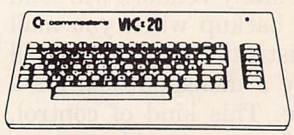

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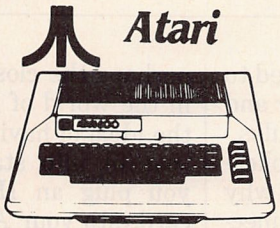

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change is nonstandard, you need to be sure that both the computer and printer understand the new rules.

Having seen some of the applications, you may be wondering why anyone would use a serial connection for a printer when the parallel interface is so much simpler. The main reason is distance. The RS-232C serial interface allows cables up to 50 feet long while the Centronics parallel interface is limited to 10 feet. Also, RS-232C allows you to connect a printer to a modem so that it can accept data directly from a phone line.

Various computer-industry standards committees have been working on possible successors to RS-232C that would iron out the problems and lead to improved performance. Until a recognized successor emerges and captures the market, though, RS-232C is likely to remain the most widely used serial interface.

IEEE-488 Interface

In the early 1970s, Hewlett-Packard developed a way of connecting a computer with as many as 14 other devices on a single cable or bus. This Hewlett-Packard Interface Bus became the basis of the interface standard adopted by the Institute of Electrical and Electronics Engineers (IEEE) in 1975 and revised in 1978, known as IEEE-488-1978 or just IEEE-488 for short. Some manufacturers also refer to it as the General Purpose Interface Bus or GPIB.

IEEE-488 interfaces are available on a vast array of equipment ranging from laboratory devices like signal generators and voltmeters to the more familiar business peripherals like printers and disk drives. Like the simple, garden-variety parallel interface, the IEEE-488 carries data along eight parallel lines and has some distance limitations. The total cable length can be no more than 20 meters or 2 meters per device, whichever is shorter.

The IEEE-488 has the advantage of being a well-defined standard, perhaps the closest approximation in the world of microcomputers to the ideal of having standard cables that fit into standard sockets. If you plug an IEEE-488 interface card into your Apple II, for example, you can control 14 IEEE-488 devices without having to worry about special cables or the other RS-232C headaches.

A special communications technique called a "three-wire handshake" makes sure that IEEE-488 communications don't get scrambled and data doesn't get lost. The technique allows the receiving device to signal whether it's ready to receive new data. The cable can carry up to 500K bytes per second, but the real transfer rate is only as fast as the slowest device using the line. Hewlett-Packard holds a patent on this handshaking technique, but the company's very liberal licensing policy makes it available to other manufacturers.

With IEEE-488, as with all hardware interfaces, you still need to be sure that you have the proper software device drivers for your equipment. It's like receiving a telephone call. The hardware allows you to hear the person on the other end, but if you don't speak the same language, you can't communicate.

—Dara Pearlman

Copy-Protection Controversies

An undeclared war is raging over your right to copy the computer programs you buy. On one side are nervous software authors and publishers who "copy-protect" or "lock" their program disks, making portions of the disks invisible or unreadable to your system's regular copy-making programs. Their goal is to foil software pirates who might sell illicit copies or pass out free copies to their friends. In the process they also prevent you from making backup copies of the program or transferring it to a hard disk.

On the other side are the lock busters, the folks who figure out how to foil the latest schemes of the copy protectors and then sell their solutions to the public. In the tradition of true warfare, each side is developing ever more sophisticated and expensive weapons. And you, the noncombatants, can end up paying a heavy price.

The law is clear. A 1980 amendment to the copyright law allows you to make a reserve copy of your software so that a disk failure won't rob you of your investment. The copy protectors usually agree that you are entitled to a backup, but they think you should get it from them. Many vendors will send you a free backup when you mail them a registration card. Many will also replace a damaged disk for a nominal fee. This kind of control, they feel, is a reasonable way to protect their products from unauthorized distribution.

The lock busters, on the other hand, point to the inconvenience and uncertainty faced by the consumer who must rely on a distant vendor to make sure his expensive software is in working order. Their lock breakers are just as legal as a locksmith's tools, they say, and it's up to the customer to use them in accordance with the law.

Some take their concern for law and ethics further though. Omega Microware Inc., the publisher of the popular lock-busting program for Apple computers called Locksmith, actually copy-protects the Locksmith disk. Ron Netzger, vice-president of Omega's technical

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department, explains that his company is trying to ensure that Locksmith is used legally. Omega reasons that the people inclined to make illicit copies of Locksmith are precisely the ones most likely to use the Locksmith program to make other illicit copies.

Isn't that hypocritical? Not so, says Netzger. The program's raison d'etre, he says, is to allow customers to make backups of software that doesn't come with a backup "at point of sale." Thus Omega will provide the right technical parameters for copying popular business software that doesn't come with two copies in the original purchase package.

Picking Locked Programs

So, spouting righteous pronouncements, the copy protectors and the lock busters chase each other round and round the mulberry bush. When Locksmith first came out in 1981, it was completely automatic, but since then copy locks have grown more and more elaborate. The demand for a simpler way to make copies has spawned a new generation of copy-busting techniques that use hardware as well as software.

The "nybble copiers" like Locksmith read the original disk one unit of information, or one *nybble*, at a time and copy each nybble exactly onto the duplicate disk. As protection schemes grow more complex, though, it's getting harder for the nybble copier to find the nybbles.

The new memory-dump copiers rely on a different principle: the underlying paradox of copy protection that requires the disk be unreadable and readable at the same time. While it stymies copiers, the locked disk has to be understandable to the computer. A memory-dump copier takes over after the computer has loaded the information from the protected disk into the computer's internal memory. Then the copier transfers the program from the computer's memory to a backup disk, which will not be locked. This kind of copier can transfer locked software to a hard disk as well.

East Side Software's Wildcard is an example of a memory-dump copier for the Apple II. It includes a plug-in circuit board as well as a program disk. Its operation is reminiscent of the early Locksmith days; for most copying jobs it is fairly automatic. However, Wildcard has its limitations. It can copy only those programs that are small enough to fit in the Apple's memory. If a program reads in multiple sections or overlays from the disk to perform different functions, the memory-dump approach won't work. The copier won't know how to reconnect all the parts.

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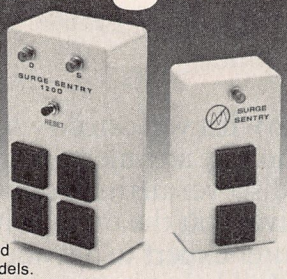

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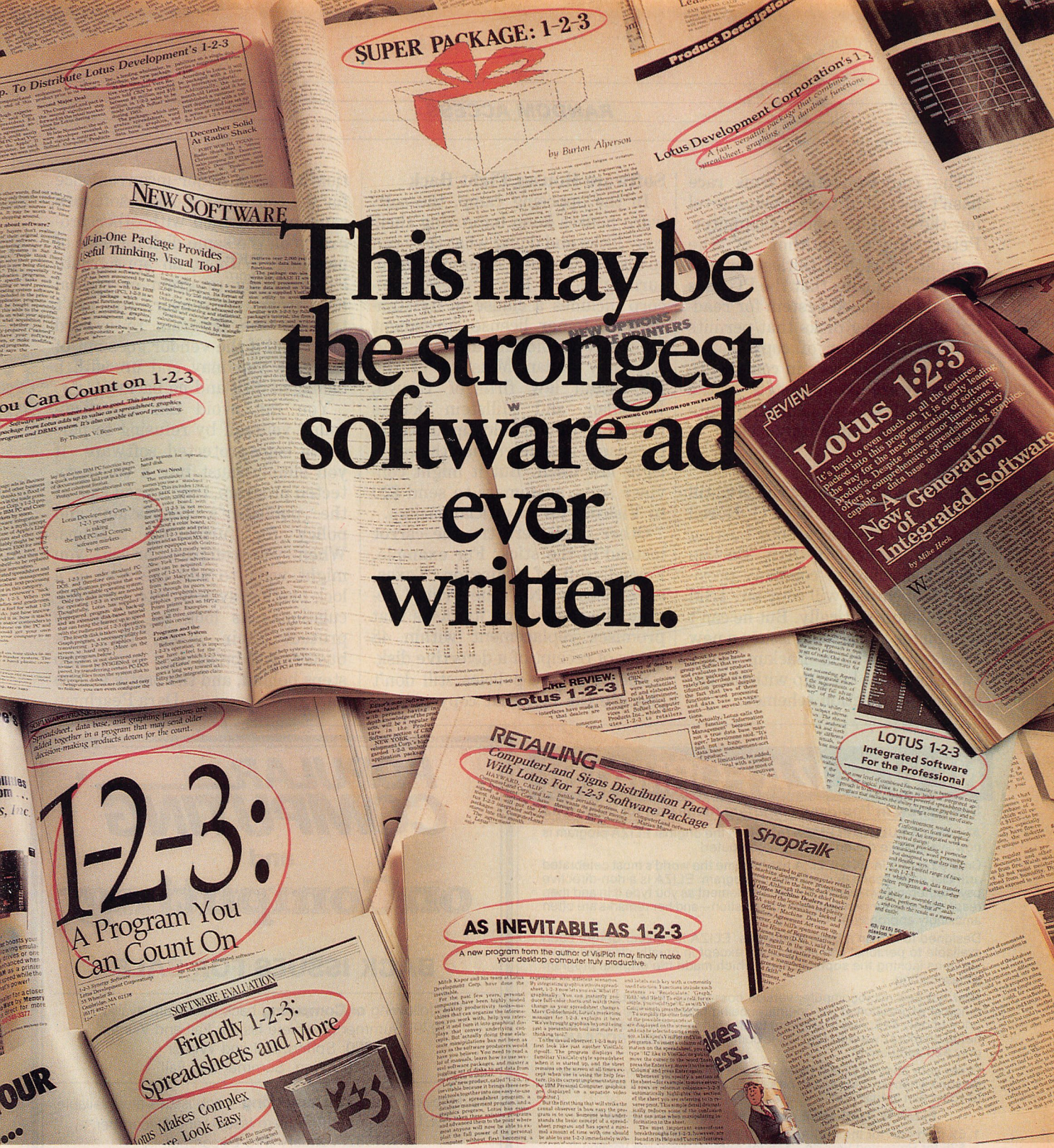

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The copy-protection arms race hasn't escalated to the same level for the IBM Personal Computer. Peter Norton, author of the popular Norton Utilities for the IBM PC, explains that the PC uses a hardware-based system for reading and writing disks that permits a limited number of copy-protection schemes. That's in contrast to the software-based system in the Apple that allows an almost infinite number of possible copy locks.

IBM Vulnerability

So the software-only copiers still work quite well on the PC. Norell Data Systems has a copy-busting program called System Backup that, according to company president Mel Norell, will copy any IBM PC disk automatically. But he can't rest on his laurels—he issues a new release of System Backup every two months to keep up with the latest copy-protection schemes.

Software Houses Fight Back

In the opposing camp, the software houses keep improving their copy locks and doing what they can to discourage their customers from turning to the lock busters. Visicorp includes a clause in its standard customer license agreement expressly forbidding any copying. Attorney Julian Millstein of the Manhattan law firm of Brown, Raysman, and Millstein doubts that this would hold up in court because it is stricter than the copyright law itself. But it might convince some customers to send $20 to Visicorp for an official backup.

Other publishers try the carrot instead of the stick. For example, Friendlysoft of Arlington, Texas, advertises a "No Fine Print Lifetime Guarantee" on its disks that promises replacement within 48 hours of receipt of a defective disk.

Such nice-guy policies still don't obscure the fact that copy protection can be a major inconvenience for the consumer. Locked software can't be combined with other programs on the same disk for ease of handling. Without an appropriate lock-breaking program or special help from the vendor, you can't transfer the program to a hard disk. And if the vendor goes out of business you may end up with a damaged disk and no backup.

You can avoid this merry-go-round yourself by refusing to purchase copy-protected software. If you simply must buy a copy-protected program, take a good look at the publisher's reputation and policy for furnishing backups. When you compare prices, you might want to add the cost of a lock-busting system into your calculations. As long as publishers protect their disks, the lock busters will be at most one or two steps behind, and the battle will go on. —Dara Pearlman

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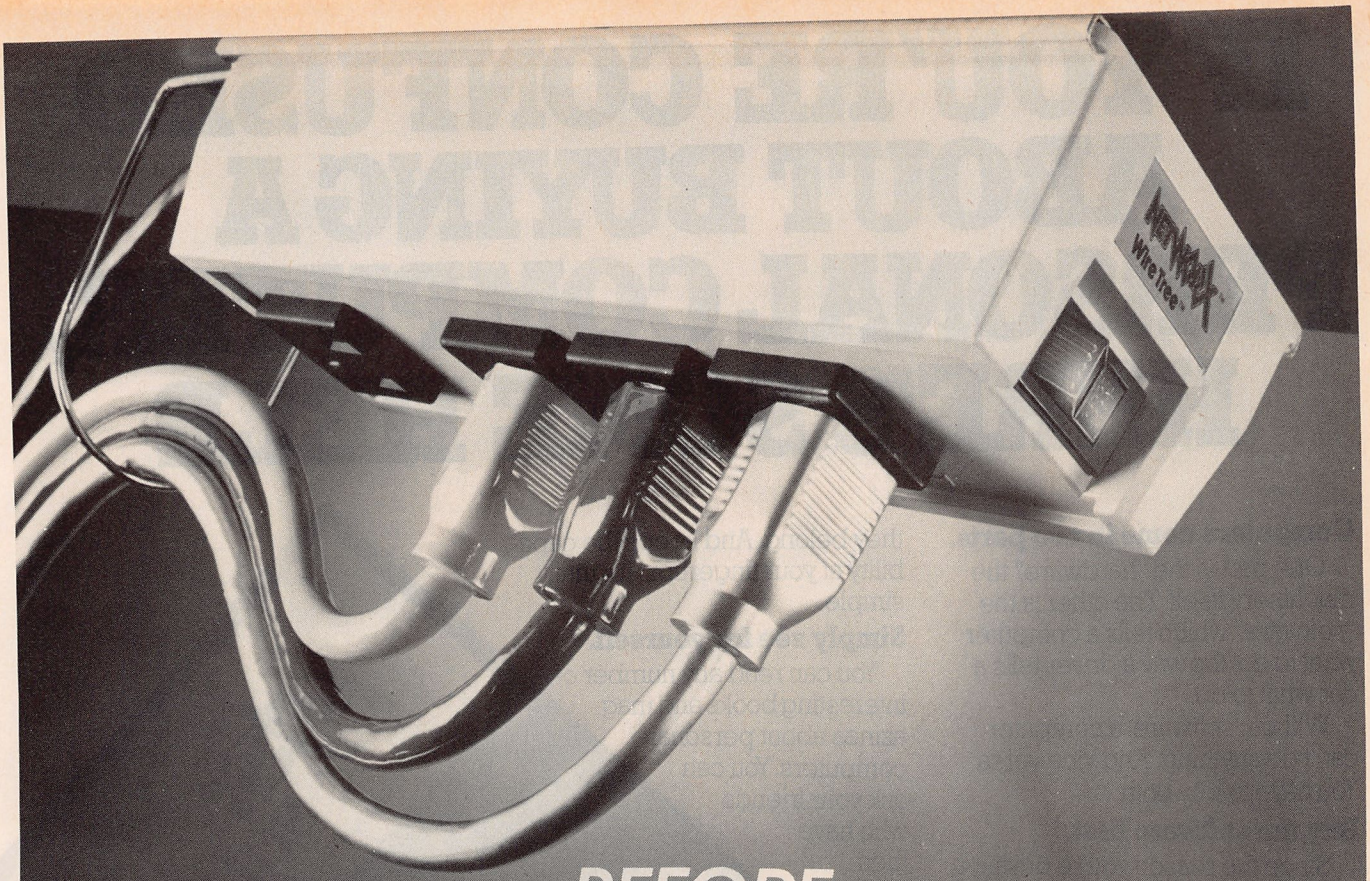

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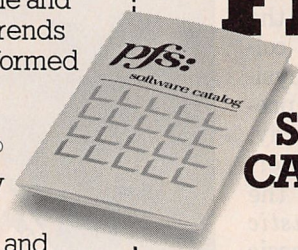

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Inner-Space Adventure

Microbe takes you on a fantastic voyage within the human body

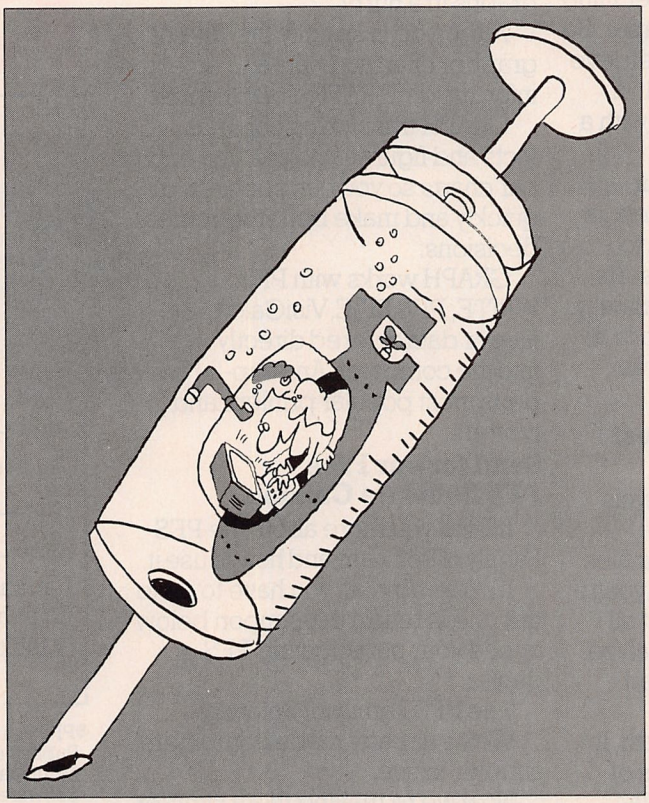
by Joseph J. Elia Jr.

Lao-tzu, a Chinese philosopher born 2600 years before the invention of the floppy disk, said that "the journey of a thousand miles begins with the first step." Unfortunately, the computer-game industry began its odyssey by stepping on a rusty nail: video-arcade spinoffs. This type of gaudy, low-brow programming was such an instant commercial success, however, that game developers were reluctant to break new ground.

Microbe: The Anatomical Adventure is one of the first computer games that refuses to follow the Pac. The result of a collaboration between physician Alan Zalta and programmer Robert Clardy, Microbe is a computerized descendant of the 1966 movie *Fantastic Voyage* (a schlock classic that starred Stephen Boyd and a stunning newcomer named Raquel Welch). And Microbe is representative of the latest wave of games that provide a smattering of knowledge (not nearly enough) as they entertain.

The game places you in command of a submarine and its crew of three: physician, navigator, and technician. After getting reduced to the size of a single human blood cell, your submarine and its occupants are then injected into a dying patient's leg vein. Using the bloodstream as a river, you and the crew must move through the patient's veins to the brain, perform some tricky surgery, and then exit the body through a tear duct.

Zalta and Clardy have devised a sort of trial-by-terror tutorial on disease and immunology. The player faces merciless attacks by microscopic organisms. (Best-case scenario: severe damage to the submarine; worst-case scenario: injury or death to the crew members.) According to Zalta, the game offers more than 5 million distinct cases, so boredom is definitely not one of Microbe's problems.

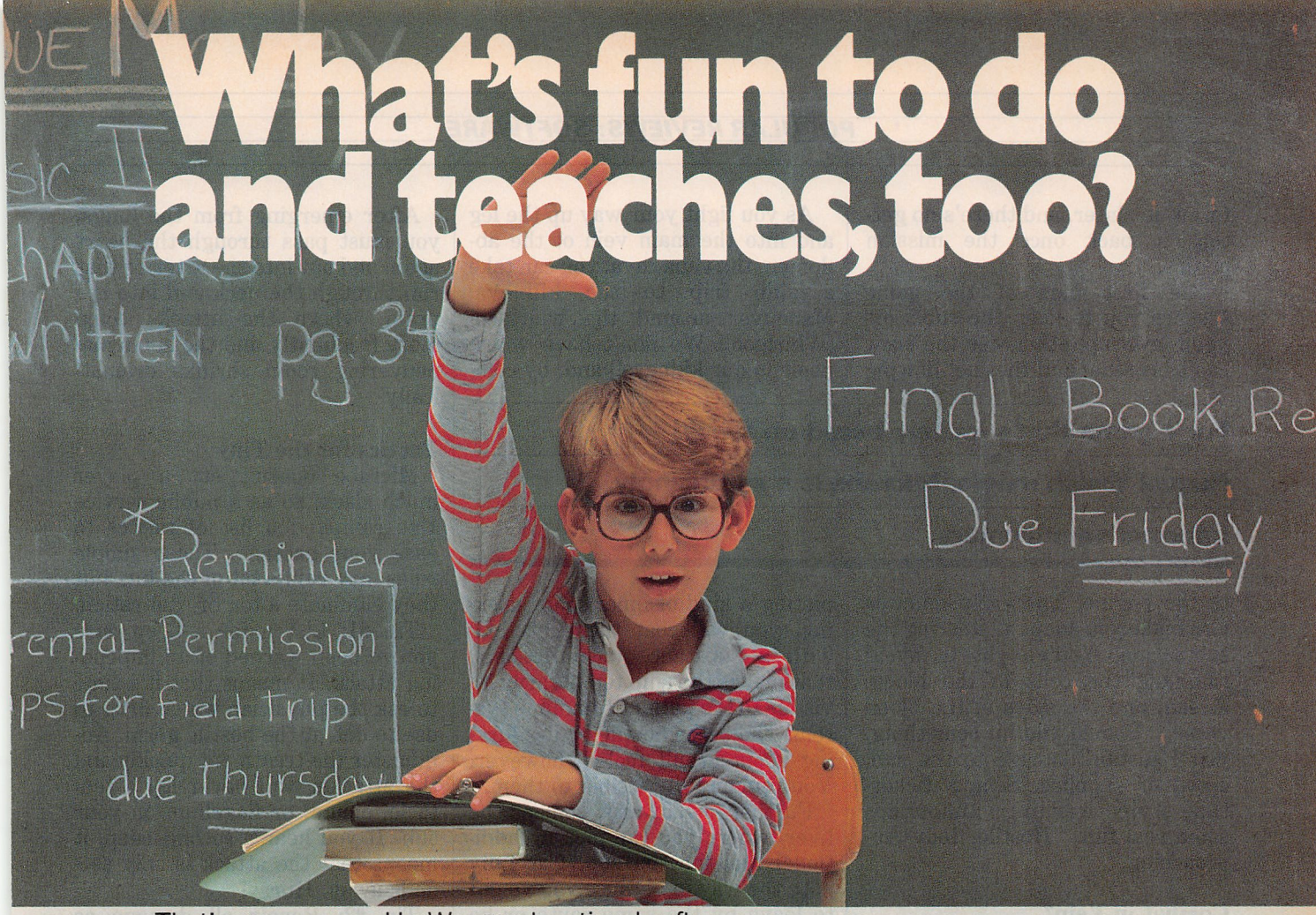


Take the example of Delilah Samson—hair stylist, age 46. She smokes and drinks in moderation and has an allergy to chloroquine, a drug used to treat malaria. According to her electronic dossier, Ms. Samson was passing the American embassy in Paris when a car bomb exploded. She suffered "severe shock and shrapnel wounds to the head and neck." One piece of shrapnel has lodged in Delilah's middle cerebral artery and threatens to cause a massive stroke unless your sub reaches the shrapnel and you remove it.

A message appears on your screen: "You and your crew should report to the miniaturization chamber immediately." But before you do, don't forget to note the patient's drug allergies as well as her surgical problems. You'll need this in-

Illustration by Niculae Asciu

What's fun to do and teaches, too?



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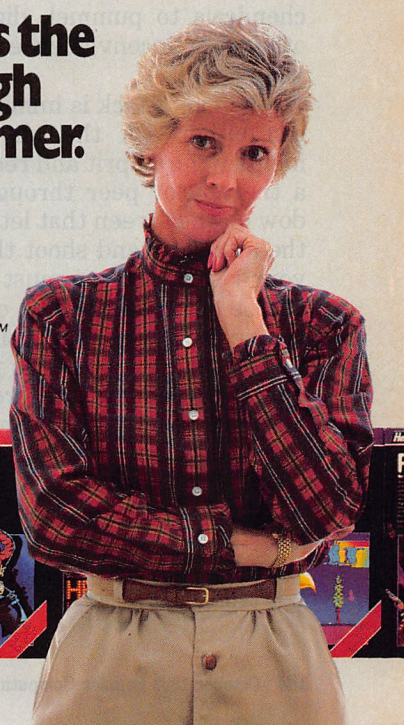

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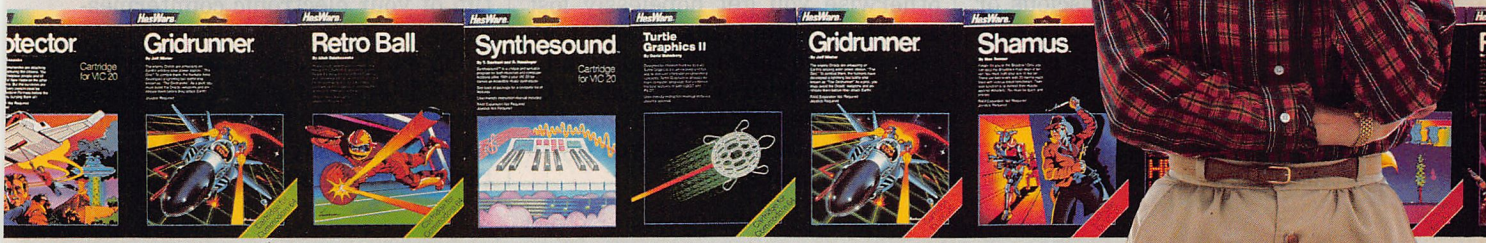

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formation later, and there's no getting it back once the mission begins.

The first part of the game teaches you to keep the sub's oxygen level up (otherwise the crew can't breathe) and the fuel flowing to the engine. The early minutes also make you adept at steering the submarine. You've got to avoid ramming the cells in the bloodstream and the sides of the blood vessels. Should you hit something, you'll sustain damage to the sub, crew, or supplies. Soon a ticker-tape-style warning announces some real fun: "Hostile Body Approaching."

For a game that's loosely based on an old Raquel Welch movie, Microbe is a surprisingly informative adventure.

Combat in Vein?

These "hostile bodies" range from nuisance germs like *Staph. epidermidis* to embarrassments like herpes to serious nasties like hepatitis or fungi with an appetite for brain cells. In addition, the patient's immune system may decide it's had enough of your sub and send its white cells and defensive chemicals to pummel, digest, and otherwise inconvenience you and your crew.

When an attack is imminent, you can either ask the physician to identify the culprit and recommend a therapy or peer through a window on the screen that lets you see the attackers and shoot them with your laser. But you must choose a course of action quickly; otherwise you're left with a persistent attacker that (crash!) ruins your supplies and renders the crew members either (crash!) unconscious or (crash!) dead. The attack ends only when you administer the correct drug or zap the hostile with your laser.

Joseph J. Elia Jr. is the manager of editorial operations of the *New England Journal of Medicine.*

As you fight your way up the leg and into the main vein of the abdomen, the vena cava, you can take a side trip to the kidneys. Maneuver around the whirlpool (Whirlpool! We don't have whirlpools in our kidneys!) and, by completing a kind of inner-space docking, you will coat the sub's hull with a substance (also fictional) that makes the ship temporarily invisible to the patient's immune system. The other hostile bodies lurking about aren't fooled, however. You remain fully visible to them.

Further headward comes the liver, where you can pick up additional fuel for the sub. Carefully note the way in because you've got to leave by the same route or be trapped (and defeated) in the bile system.

The heart is the final obstacle between you and Delilah's lungs. Here you use a defibrillator to stop the heartbeat and then race through the open valves before restarting the heart. Should you try to enter the heart before stopping it, the pressure will crush the sub's hull like a beetle on a summer sidewalk. And if you forget to restart the heart once you're safely through it, Delilah is a goner.

So far you've passed through the right half of Ms. Samson's heart. To make it through the other half and into her brain, you must first pass through the lungs.

Each of Microbe's lungs consists of about 30 interconnected boxes, which the player sees one at a time. Careful mapmaking is essential; otherwise you get hopelessly lost and the mission fails. About midway through the maze, you'll find a place to bolster air supplies. Of course, the attacks from the hostiles continue even as you try to draw your maps.

After emerging from the lungs, you must pass through the heart again and out into the arteries that run through the neck and into the brain, where the attacks come more frequently and the sub's maneuvering room shrinks dramatically.

Tactics for the Tiny

Microbe doesn't cut a player much slack, so as a public service I've compiled a list of tactics to ease your passage. These simple rules may ruin a bit of the fun, but they eliminate a ton of frustration.

Tip #1: Listen for a beep once you've been warned of an impending attack. It means that it's time to ask the physician which drug to use to defeat the hostile germ. Administer the treatment quickly and the attacker will never lay a tentacle, cilium, or flagellum on your sub. If you hear a second beep, it means that the attack is only seconds away. Hurry!

Tip #2: Repair all damage as quickly as possible. And when you reach the heart, let the sub idle in midstream just outside the valve while the technician fixes everything that's salvageable. The entrances to the heart offer a modicum of safety from attack, so they're good places to put in for repairs before making the final run up to the brain.

Tip #3: Don't try shooting your way through mucus blockades in the lungs. If you try to bore through with the laser, you risk nicking the lung wall, which ruins your mission. When you enter a lung "box" and observe that the passage is blocked, just do the cowardly thing: retreat. Go back to the previous box, then turn around and reenter the box that halted your progress. Usually the blockage will have disappeared—a victim of your electronic countermeasure.

Tip #4: To stop the action at advanced levels of play, press Q for quit. When the program asks for confirmation, say no (N) and the action will resume later (after you've

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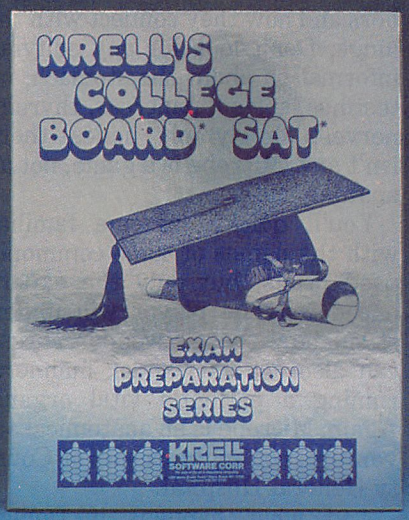

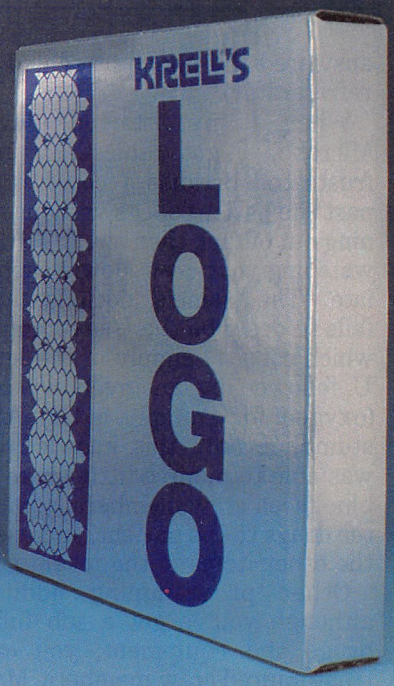

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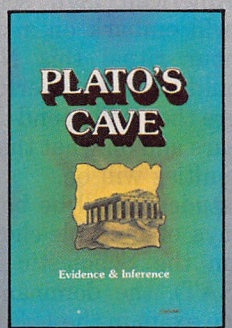

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answered the phone or raided the refrigerator).

When I first started playing Microbe, I got table-slammingly frustrated because I couldn't get past the patient's legs without running out of fuel, then air. It's a drag watching your crew slowly asphyxiate. The game's documentation fails to describe the Use command, which consists simply of the letter U followed by an inventory code (oxygen, for example, is U2). After stumbling onto this knowledge, I was able to pump a little air to my blue-faced crew members, administer drugs to the patient, and use all the other items in the inventory.

Other programming oddities: although you've got a sub full of drugs and equipment, you can't treat injured crew members. Moreover, the blood cells that the sub must dodge in the legs and neck disappear mysteriously in the major organs (kidneys, liver, heart, lungs, and brain). Where do these cells go? Why not banish these navigational nuisances altogether?

Microbe doesn't teach you much about the nature of blood clots, but you will get a general idea of the arrangement of the heart's chambers and how they connect with the lungs. Don't look for any edifying information about the stomach, intestines, spleen, pancreas, thyroid, nerves, or lymph nodes—there isn't any. Microbe is a game, not an anatomy class.

You'll quickly become familiar with the names of some commonly used drugs, but only the experienced Microbe player will understand how these "wonder cures" can also act as wonder maimers, ruining a patient's vital organs. Again, Microbe is an anatomical adventure, not an internship at County General Hospital.

And what happens if Delilah Samson dies because of *your* sloppy play? Alas, Microbe's big drawback is its failure to provide an electronic autopsy room. At game's end, all you get is a score, not an explanation of *why* Delilah died. Anyone who's ever watched Jack Klugman pace, moan, and tear his hair out as the compulsive coroner on the TV series *Quincy* knows that the fantastic voyage is never over until we fathom why the fantastic gift—namely, life—has been taken away.

Although Microbe succeeds as the "anatomical adventure" it claims to be, I wish its programmers had jettisoned some of the arcade effects. With a greater emphasis on education, Microbe could have been less of an adventure and more of an experience. □

At a Glance

Name: Microbe: The Anatomical Adventure

Type
Medical adventure game

Manufacturer
Synergistic Software
830 North Riverside Dr., Suite 201
Renton, WA 98055
(206) 226-3216

Price
$44.95

Format
5¼-inch floppy disk

Computer
Apple II, II Plus, or IIe with 48K-byte random-access memory and one disk drive; joystick optional

Documentation
46-page instruction booklet

Audience
Fans of inner-space games

EDUCATION

Computer Coaching for the SAT

A few days at the keyboard could help you get into the college of your choice

by Peter Owens

With butterflies swirling in their stomachs, nearly a half-million nervous American high school students will embark on a punishing three-hour ritual this November that could have a powerful impact on where they will spend their next four years and on what their career opportunities will be.

The students will be bombarded by arrays of multiple-choice questions on the Scholastic Aptitude Test (SAT), the dominant college entrance exam in the U.S. All their years of studying language and mathematics will be reduced to a computer readout that rates them on a scale of 200 to 800 on each section of the exam. Currently, national averages stand at 426 for the verbal section and 467 for math.

Although less reliable than high school grades as a predictor of performance in college courses, many colleges and universities view these scores as important if not crucial determinants for admission. The pressure to perform well on these tests is immense. For this reason, many high schools now offer special classes to coach students for the SAT. Some students even sign up for after-school and weekend coaching as well.

For many years the Educational Testing Service (ETS), the designer of the SAT, has maintained that because the SAT tests general abilities developed over a lifetime of learning, scores could not be significantly altered by any form of coaching. But after locking horns with a number of authorities, including Ralph Nader and the Federal Trade Commission, ETS has recently changed its position, acknowledging after reviewing a

Peter Owens is a professor of English at Southeastern Massachusetts University.

number of studies that SAT scores can be significantly improved through careful preparation and systematic coaching.

ETS spokesperson Richard Noeth concedes that a 20- to 30-point gain is possible following 6 or 7 weeks of specialized coaching. Officially, ETS falls short of endorsing coaching, however, and warns students and parents that before signing up for extra preparation "you should satisfy yourself that the results of a special program or course are likely to make a difference in relation to your college admission plans."

The Krell Challenge

With the spread of microcomputers and increased interest in computer-assisted instruction, the development of software designed to prepare students for taking the SAT was inevitable. In fact, more than 10 packages are now available to help a student get ready for the test. Krell Software Inc., the developer of one package, offers a money-back guarantee if your test scores don't improve by at least 70 points after using its programs a minimum of 6 hours. Krell claims that it has based its offer on data from classrooms where earlier versions of its package were used. (The guarantee applies to individual purchasers only and not to schools, however.) In this article, I'll review three such packages, one for $299.95 from Krell, another for $1450 from Borg-Warner, and a third for $49 from Edu-Ware.

Is Krell's guarantee outrageous? To achieve that 70-point gain, students must perform better than those who use other forms of SAT preparation. Average students show gains of 20 points just by taking the test a second time. Studies show that good coaching without a computer leads to consistent gains of 20 to 35 points. SAT scores can also fluctuate as much as 30 points because of chance variations from test to test. Thus with a bit of luck and good coaching, students can hope to increase their scores by 70 points. On the other hand, because most Krell users are likely to be highly motivated to succeed—with a personal investment of $300, who wouldn't be?—they'll probably spend a lot more than the minimum six hours and may do very well indeed.

ETS's Noeth applauds Krell's guarantee but expresses concern about all forms of SAT coaching. "If only wealthy people can afford coaching, then the SAT is not as equitable as it should be." He also points out that besides money, time is at stake—time that could be devoted to conventional literature and math courses that ETS recommends over coaching courses as a means of improving performance.

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Who Coaching Can Help

While it is easy to become perilously entangled in the SAT numbers game, careful research has shown that some people are more coachable than others. If you are considering the use of a computerized coaching package, it's especially important to understand the key factors involved. Nancy Cole, a researcher who has analyzed the effects of coaching for the National Research Council, says that "indirect evidence suggests that not all students can be expected to gain equally from coaching." If you know your subject but tend to do poorly on tests, you stand to gain a great deal, says Cole. If, on the other hand, the test is fundamentally too hard for you, coaching probably won't help much.

As we noted previously, SAT scores can fluctuate plus or minus 30 points because of chance alone. Each question on the exam is worth roughly 10 points, so merely having the bad luck of not knowing a few key vocabulary words could have a more profound effect on your total score than coaching does. Studies also indicate that students who score disappointingly low the first time they take the test stand the best statistical chance of gaining in retests.

Students who experience severe test anxiety can be helped a great deal by practice that desensitizes them to the stresses of testing. Another important factor is "test-wiseness"; students who learn testing procedures, logical formats, and question-answering techniques can also improve their scores. Furthermore, student motivation is a key factor. Highly motivated students who take coaching courses demonstrate greater gains than less motivated students who are coached.

Practicing Vocabulary Skills

Microsystem 80 College Entrance Examination Preparation, designed by Borg-Warner, is the most elegant and expensive ($1450) of the packages reviewed here. Because the SAT verbal exam includes vocabulary, reading comprehension, and verbal analogies, a good preparation package must include all these categories. Borg-Warner offers a thorough look at each with its greatest strength being a 350-word vocabulary-building component distributed over 5 disks. The package offers both testing and learning modes with special emphasis on learning throughout the entire coaching program.

In the test mode the program displays words with 5 matching choices, and you are given 30 seconds to answer each item. Fifteen program modules with selections of 20 and 25 words test your matching

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ability for both synonyms and antonyms. Your overall score is reported on the SAT 200-to-800 scale, and you are told whether your responses are correct, correct but slow, incorrect, or omitted.

For most of the modules, the program offers an in-depth review of the responses. It provides correct answers along with definitions and uses of the words in context. You are quizzed within the module and then retested after completing the learning mode. The timing and reinforcement are excellent; the level of difficulty of words is appropriate and commensurate with the moderate-to-difficult items on the SAT vocabulary section.

I found Borg-Warner's timing device very useful as an aid in pacing, and after several hours on the program I came away feeling I had learned many more words with greater depth than I learned using either the Krell or Edu-Ware verbal packages. I was a bit frustrated at times because the program does not let you skip ahead from module to module. The program is carefully paced and highly regulatory. For the most part, this structure is a help for learning new words but a slight handicap for test-taking drill and practice.

The Borg-Warner program was clearly superior to the others at outright instruction. And although the program's word list may not reflect all the items on the SAT's ever-changing word list, I was pleased to learn words for their own inherent values and found the thoroughness of my learning to be a confidence booster.

Yet while the program is excellent for teaching vocabulary, the Borg-Warner package does not strictly follow the format used on the SAT exams. For example, Borg-Warner tests both synonyms and antonyms, whereas the SAT uses only the more difficult antonyms for testing vocabulary.

In contrast, Krell confronts the user with antonyms only and a much more rapid program format. In the Krell verbal program, you are given five antonym options for a word, and after you select the answer, the program immediately evaluates your response and provides the correct answer and keyword definition. Although the instant feedback is useful, Krell doesn't offer the extensive learning mode, relying instead on rapid trial-and-error feedback. A wise user would write down words that he has missed for further study. Eventually, any words you've missed come back either as keywords or as choices for matching in a rearranged format.

As a mechanism for familiarizing a student with the format of the SAT (test-wiseness) and for reducing test anxiety by desensitizing the student to format-related distractions, I judge the Krell program superior. It kept questions coming at me until the SAT format was as familiar as tossing basketballs in a backyard hoop.

When I asked a high school student to try the Krell and Borg-Warner programs, he preferred the Krell program, largely because it was faster and provided instant answers. I suspect that Borg-

At a Glance

Name: Microsystem 80 College Entrance Examination Preparation

Type
SAT verbal and math tutorial

Manufacturer
Borg-Warner Educational Systems
600 West University Dr.
Arlington Heights, IL 60004
(312) 394-1010

Price
$1450

Format
Twelve 5¼-inch floppy disks

Computer
Apple II and IIe

Documentation
52-page Teachers Guide with plastic-coated cards for reading comprehension in vinyl enclosures

Audience
Schools and students preparing for SATs

Name: Krell's College Board SAT

Type
SAT verbal and math tutorial and The Standard Written English test

Manufacturer
Krell Software Corporation
1320 Stony Brook Rd.
Stony Brook, NY 11790
(516) 751-5139

Price
$299.95

Format
5¼-inch floppy disks

Computer
Apple II and IIe, Atari 400 and 800, Commodore 64, Franklin 1000 series, IBM Personal Computer, TRS-80 Models I and III; one disk drive

Documentation
48-page user booklet with passages for reading and sample work sheets for math

Audience
Schools and students preparing for SATs

Name: PSAT and SAT Word Attack Skills

Type
PSAT and SAT verbal synonyms and antonyms tutorial

Manufacturer
Edu-Ware Services Inc.
POB 22222
Agoura, CA 91301
(213) 706-0661

Price
$49 each

Format
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Computer
Apple II and IIe

Documentation
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Audience
Schools and students preparing for PSATs and SATs

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Warner, my own preference, is more suitable for adults who have the patience to work through the learning mode.

Both programs are considerably more engaging and less intimidating than several thick commercial preparation manuals I looked at. The computer focuses the user's attention on one item at a time, thus reducing the sense that test preparation is an overwhelming task.

Another strength of the computer is that it takes care of all clerical duties and directs the student firmly along the test's pathways. One problem with preparation manuals is that they require self-scoring and careful self-regulation. It is fairly easy for students to make errors, to misinterpret scores, or to be sloppy in assessing their levels of success.

The most intriguing albeit least successful of the SAT-preparation packages is the Word Attack Skills program produced by Edu-Ware. What is promising about the package is its attempt to use the sound theoretical principle that words can be broken down into parts so that their meanings can be logically determined. Many words in our language are constructed from root words. When we attach prefixes (beginnings like *pre, cog, ven*) or suffixes (endings like *gress, tious, tion*) to simple roots, we generate complicated but understandable meanings.

The problem with the Edu-Ware package is that after introducing a menu of lessons based upon these principles, the program gives us a rather limited selection of words. And when it provides feedback about incorrect answers, the program frequently fails to reinforce the word-attack principle. Because the program did not continuously force me to practice the word-attack process, I did not really learn it. Instead, I resorted to memorizing the word's synonym or antonym as the easiest way to select correct responses. Thus the program fails to teach word-attack skills as a means of preparing for the test, and it is simply too short and offers too few words to significantly expand vocabulary.

The Edu-Ware package is built on the sound theoretical principle that words can be broken down into parts and their meanings determined logically.

The Edu-Ware package does not include word analogies, reading comprehension, or math and thus cannot stand alone as a comprehensive SAT-preparation package. However, Edu-Ware will soon be releasing a math-preparation program, and if the company makes some refinements in Word Attack Skills, the packages could compete for effectiveness with the more expensive packages.

Practicing Verbal Analogies

Among the most coachable items on the SAT verbal exam are word analogies, which account for 20 of the 85 questions. Remember those brain-teasing pairings? Is yawn: boredom equivalent to anger:madness? Or is it like smile:amusement? These are problems in logical relationships, and both Krell and Borg-Warner do a good job with these analogies.

What can be coached reasonably well is sensitivity to the relationships between items in analogies. Sometimes the items are opposites; sometimes the second item is a specific member of the first item's larger class; or as in our sample above, sometimes the first item is an action resulting from the second. Practice can help the user become more proficient at finding these relationships, thereby helping to reduce test anxiety as well.

Krell offers analogies in the SAT format and then provides both the correct answer and a brief explanation of the relationship after you've chosen your answer. Borg-Warner uses its testing and learning modes to achieve similar ends. In this case I preferred the instant feedback provided by Krell and found the slower method in the Borg-Warner package to be less efficient at exposing me to a broad range of relationships quickly.

Both Krell and Borg-Warner do well in providing vocabulary fill-in items that test a student's ability to recognize word meanings in contexts of sentences. These fill-ins account for 15 items on the SAT. Krell and Borg Warner also offer reading-comprehension sections in which the user reads a passage supplied in the program documentation and then answers questions about the passages asked by the computer. Twenty-five items on the SAT are devoted to reading comprehension. But while the computer evaluates responses quickly, I don't see much advantage in using a computer for these items. The computer does not capture the fidelity of the process as well as printed manuals or the SAT's own test-preparation booklets do.

Testing Math Anxiety

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Coaching in math has been a bit more successful in bringing about increased test scores than has coaching in verbal skills. Of course, students who take additional math courses in high school usually do better than those who avoid math and don't expand their knowledge through conventional course work. But students who have the great-

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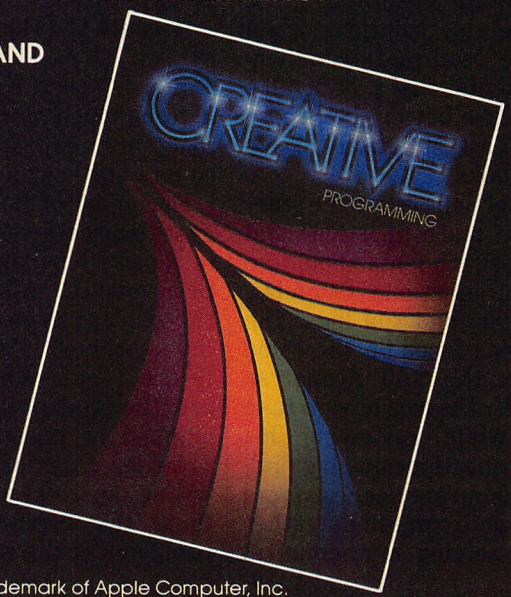

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est need to improve their SAT math scores probably don't have time to make up all those lost years. Thus SAT math-coaching software must concentrate on building test-wiseness and bolstering the student's confidence in his or her math background.

It is critical that a coaching program show students a variety of uses for the facts they already know and strengthen any skills that are weak and may be required on the exam. The SAT-preparation programs from Krell and Borg-Warner attempt to do both.

Krell's Mathskills

After working through the 15 sections in Krell's Mathskills program, I had to admit that the program made a serious attempt to address the above concerns and actually do a bit more. Mathskills has an "automatic learning mode" that permits the program to use a student's prior performance to select new problems for the student to confront. This feature forces the student to spend the most time in the areas that need the most attention.

Every problem gives the user several options after the question has been answered. The first is the opportunity to see a detailed explanation of how to solve the problem correctly. In spite of the fact that the program sometimes gives abstract algebraic solutions when it could have used more commonsense arguments, many of Krell's explanations are better than those offered by most standard mathematics textbooks.

The early sections cover the standard types of math questions and facts that most students should be familiar with: equations, formulas, word problems, and the like. The middle sections focus on the same facts but use the SAT format so that the student learns how to take the exam while reviewing his math. These questions involve finding a relationship between two sets of numbers or expressions rather than simply solving mathematical equations. This kind of math problem—like the verbal analogies—is the most difficult to do and the most important to practice.

Krell's program offers a series of increasingly difficult problems of this type, finishing with problems that are actually more difficult than those on the SAT itself. It also offers solutions to help the student understand the problems.

A second useful feature is that a student can ask for another problem of a particular type, allowing extra practice on those that are difficult or unfamiliar. Moreover, every time I answered a problem incorrectly, I was exposed to the same concept again a few problems later.

Generally, Mathskills is an excellent package. It combines test familiarization, math facts, and various contexts in which to use them in an organized, clearly presented series. It does the job of coaching very well and may even teach some mathematics at the same time. As part of a carefully planned program, this pair of disks could be an effective teaching tool. I did not find Krell's system for scoring to be especially useful, however, because scores do not reflect the way that SAT scores are computed on the 200-to-800 scale.

Borg-Warner's Math Tests

Because the Borg-Warner Microsystem 80 package is much more expensive than Krell's, I expected it to be much more imaginative. It met my expectation on some counts but not on others.

Each part of Borg-Warner's program leads off with a pretest which is followed by an analysis of the performance. After the analysis, the student goes through a teaching session with 20 problems of different types. After finishing the set, the student can redo the ones skipped or missed. The program provides a set of hints after each wrong answer until the student finds the correct answer. New problems of the same type are not

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offered for solution, however.

After the teaching session, the program gives a posttest with an analysis of the results and a corresponding SAT score. I was rather surprised to be congratulated with a "well done" for a score of only 360 on my posttest, a minor flaw in the program's attempt to be friendly. But the hints given in the follow-up exercise were very helpful. They lead the student to the correct solution rather than just handing it over on a platter.

As in the verbal package, the math learning mode is a bit slow but works effectively. While the questions in the Borg-Warner program were a little more rigorous than the Krell questions, I did not find either the quantitative or logical-relationship problems to be as plentiful or comprehensive as those in the Krell package. The Borg-Warner program is, however, more rigid in directing the student toward working on weaknesses until they are overcome. The package times the student's responses to regulate pacing, which should help an anxious student learn to cope with time limits of the SAT. The analysis in the pre- and posttests coupled with the timing and problem rigor are the real strengths of this series. This program has obviously been planned carefully and could be a strong component of a general SAT-preparation program.

What to Look For

Although coaching without a computer can help students improve SAT scores, the quality of such coaching fluctuates considerably. Computers offer standardized instruction, and both the Krell and Borg-Warner packages offer solid instructional approaches that can be used either in formal courses or stand-alone tutorial activities.

The computer offers guided practice, rapid feedback, and ease of use, all of which are likely to enhance motivation. For those disabled by test anxiety, the computer offers relentless exposure to the test formats. After a few hours of work, I was considerably less anxious about test questions and much more comfortable with the testing environment. This confidence transferred well to sample SATs, which seemed less intimidating and less mysterious after practice on the computer. Thus, I score both packages very high for enhancing test-wiseness and reducing anxiety and distractability. In addition, I found that my performance level began to average out. I became comfortable with a certain level of wrong answers and was less prone to the irritation, anger, frustration, and helplessness they can cause.

The computer offers guided practice, rapid feedback, and ease of use. And for students disabled by test anxiety, the computer provides relentless exposure to the test formats.

A software buyer should be sure a package offers a comprehensive look at the full spectrum of SAT questions. The Edu-Ware Word Attack package offers only vocabulary items, which account for fewer than half the possible total points on the SAT verbal section. A package must also have enough questions and items to support long-term study. I was able to memorize all incorrect items in the Edu-Ware package in less than three hours. Students with average verbal ability can expect longer exposure before mastery, but program size is still a problem. The Krell software with its randomization features is really superior in this regard and can support many hours of work for an average student. And despite Krell's guarantee of a 70-point improvement after only 6 hours, all other coaching evidence suggests that 25 hours or more yields best results. Getting your money back from Krell would be poor recompense for missing out on the college of your choice.

The speed of a program is another important factor. Both Borg-Warner and Edu-Ware timed the user's response, but the Edu-Ware program was so slow in presenting items that I think I would have benefited more from a testing manual. Although Krell did not time responses, its instant feedback allowed me to cover dozens of items in a few minutes and to become totally immersed in practicing for the test.

Final Considerations

You should also consider whether you want to gain primarily testing practice, for which Krell is superior, or whether you want to build your knowledge, for which Borg-Warner is tops. Finally, as new packages come on the market, you should make sure the degree of difficulty of the questions corresponds to the difficulty of the SATs. I found no problem with any of these packages in this regard. Because SAT items become increasingly difficult as you work through the test, you want a package that tests the middle- to upper-level range of difficulty, where frustration and other negative test effects are likely to occur. Keeping these considerations in mind, you should invest accordingly, knowing in the end that the SAT numbers game is finally won or lost in the admissions office, where other factors are weighed against these important but finite scores. □

Editor's Note: Mathematics professor Rufus Winsor of Southeastern Massachusetts University helped to evaluate the mathematics packages from Krell and Borg-Warner.

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BUSINESS

Visicalc Add-Ons

Three new overlay programs to enhance your Visicalc applications

by Paul C. Conover

Ever since Visicalc was first distributed back in 1978, users have asked for more features and capabilities. In fact, according to people at Visicorp (distributor of the original Visicalc), users and in-house programmers had requested more than 250 potential enhancements within 6 months of the program's release.

To meet these demands, Visicorp identified, argued over, and eventually settled upon which enhancements to include in its new product, Visicalc Advanced Version. With the new version, all was right with the world. The only problem was that Visicalc Advanced Version requires a minimum system configuration of 128K bytes of random-access memory (RAM), and most current Visicalc users don't have this much memory in their computers. The market niche created by the demand for enhancements to the original Visicalc made a great opportunity for programmers to offer their own solutions. Hence, the Visicalc add-on market was born.

I've been using Visicalc for nearly five years. I designed my spreadsheets to conform to the capabilities and limitations of the original program. Often I had to perform tortuous and convoluted procedures to move data from one spreadsheet to the next. This was both time consuming and aggravating. I developed overlay techniques and command files and even wrote a BASIC program that moved the text files from one place to another. All the time I kept thinking there had to be a better way. Now, thanks to the add-ons, there is.

Recent versions of Visicalc (above revision 1.7) incorporate a handy feature based on a new DIF (Data Interchange Format) function (/S#S), which pulls data out of one work sheet and lets you move the data to another. This was a major new capability and, in turn, opened the door for a number of work-with-Visicalc programs. In this article, I review three of these programs: Mergecalc, Vis/Bridge/Report, and Micromarkets.

Paul C. Conover is president of Praxsys Communications in Sudbury, Massachusetts, and the author of Visicalc Business Forecasting Models, a series of templates distributed by Visicorp.

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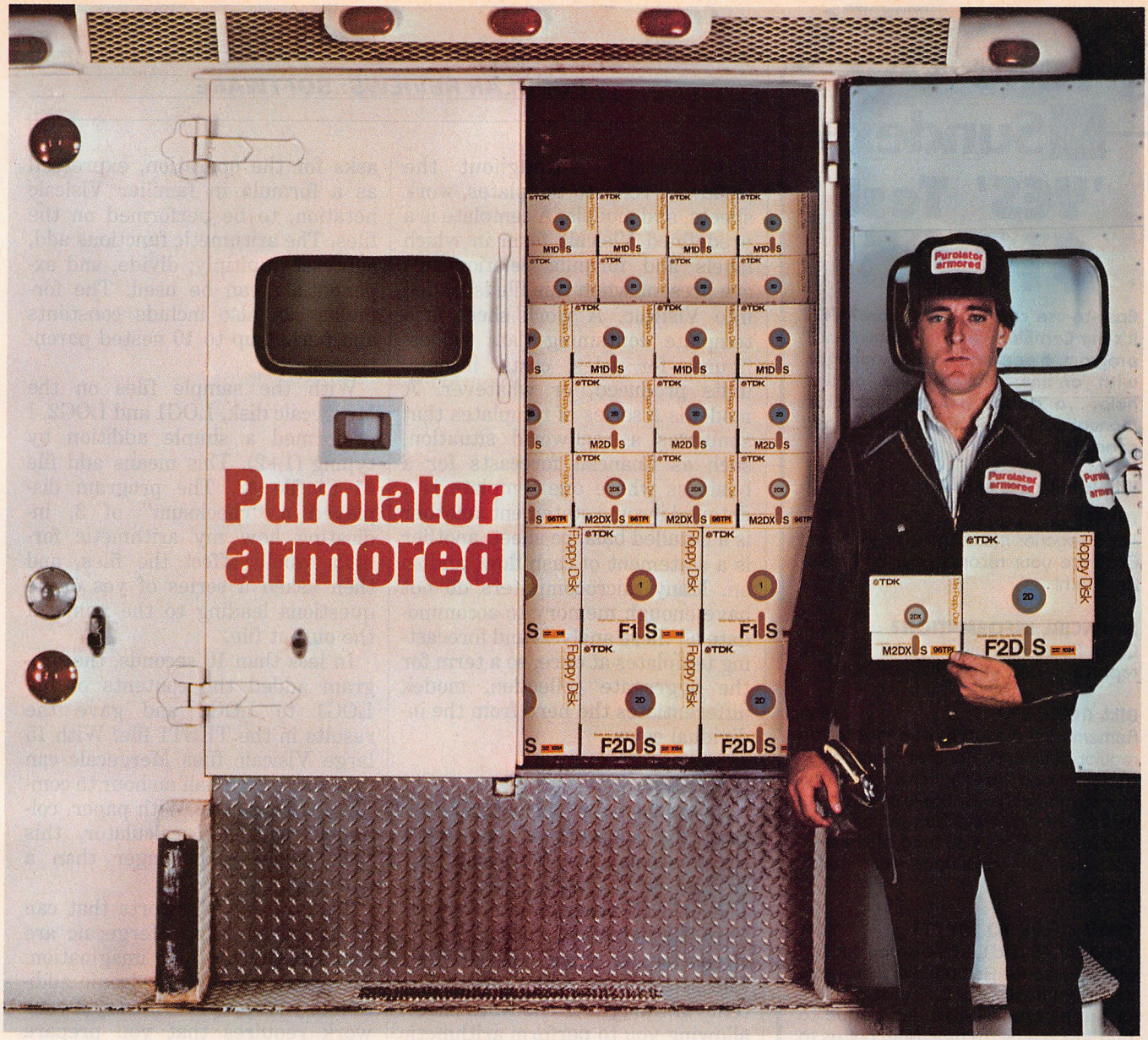

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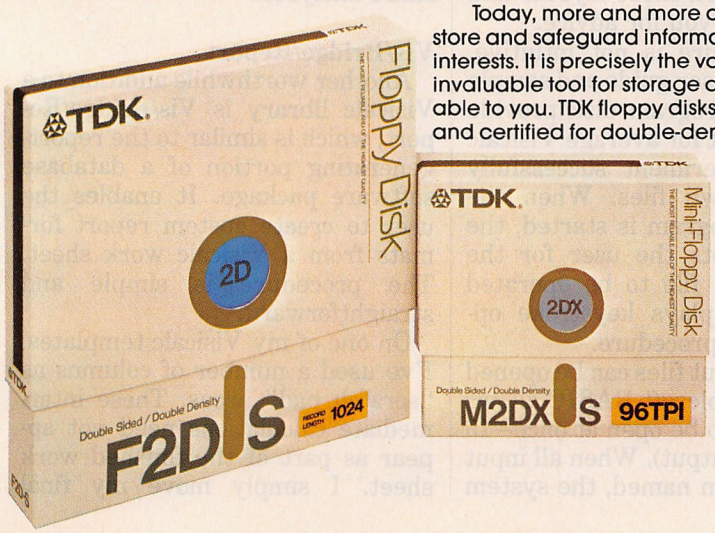

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Incidentally, throughout the reviews I refer to templates, work sheets, and models. A template is a predefined Visicalc form in which labels and formula relationships are present when this file is loaded into Visicalc. A work sheet is a template containing data values: figures for sales, costs, income. units produced, or whatever. A model is a series of templates that simulates a real-world situation, such as financial forecasts for a business where one template is a detailed income statement, another is a detailed balance sheet, another is a statement of cash flow, and so on. Many microcomputers do not have enough memory to accommodate all these analysis and forecasting templates at once, so a term for the aggregate collection, model, differentiates the herd from the individual cows.

Mergecalc

If you've ever wanted to compare the contents of one work sheet with another, Mergecalc may be just what you're looking for. This BASIC program lets you perform mathematical operations between two or more Visicalc files. The program operates on the contents of the cells in the work sheet, allowing you to perform arithmetic comparisons between files. The work sheets must be nearly identical to accomplish this, but the program catches discrepancies between the work-sheet layouts and then prompts you for advice.

The procedure is not intuitive, but the brief user guide and sample files on the program disk provide enough insight for average Visicalc users to experiment successfully with their own files. When the Mergecalc program is started, the screen prompts the user for the name of each file to be operated upon and displays keystroke options for this procedure.

Up to 15 input files can be opened at a time (Applesoft BASIC allows only 16 files to be open at once—15 input and 1 output). When all input files have been named, the system asks for the operation, expressed as a formula in familiar Visicalc notation, to be performed on the files. The arithmetic functions add, subtract, multiply, divide, and exponentiate can be used. The formulas can also include constants and permit up to 10 nested parentheses.

With the sample files on the Mergecalc disk, LOG1 and LOG2, I performed a simple addition by typing (1+2). This means add file #1 to file #2. The program displayed a "checksum" of 3, indicating how my arithmetic formula would affect the files, and then asked a series of yes or no questions leading to the name of the output file.

In less than 10 seconds, the program added the contents of file LOG1 to LOG2 and gave the results in the TEST1 file. With 15 large Visicalc files Mergecalc can take more than half an hour to complete the process. With paper, columnar pad, and calculator, this task would take longer than a workday.

The variety of reports that can be prepared using Mergecalc are limited only by your imagination. Mergecalc can be a welcome addition to your program library if your work requires that you prepare consolidated financial, performance, or time-change reports; perform variance analysis; or determine percentage-of-market-share analyses.

Vis/Bridge/Report

Another worthwhile addition to a Visicalc library is Vis/Bridge/Report, which is similar to the report-generating portion of a database software package. It enables the user to create custom report formats from a Visicalc work sheet. The procedure is simple and straightforward.

On one of my Visicalc templates, I've used a number of columns as "scratch pad" areas. These intermediate calculations need not appear as part of the finished work sheet. I simply move my final

results to another report area lower down on the work sheet and then print this rectangle of data cells. In some cases, the number of line items in the working area fills the available memory, so I split the job into two different work sheets and then reconsolidate it using DIF to obtain the finished result. Vis/Bridge/Report eliminates the need to allocate memory to a print field on the template because it lets me determine which columns and rows I want printed in a report.

When I'm finished with my calculations, Vis/Bridge/Report lets me define which columns I want in my report by entering a coded column format in the first row of each column on the work sheet. Here I can specify whether or not I want this column included in the report, how wide I want the column to be printed, whether the information is to be right or left justified or centered, and how many decimal places I want to appear.

For multipage reports, Vis/Bridge/Report numbers each page and includes the column and repeatable row headings on each page. This feature alone saves me many hours every time I run long reports for clients by eliminating the need to format each page individually. I can now modify and consolidate several of my templates because the program can move any columns that would appear in a report wider than 132 characters onto the next page, including the header information. Thus if my finished report had 25 eight-character columns of data, I could split the columns up to appear on consecutively numbered sheets, each with appropriate column headers and row labels.

Vis/Bridge/Report allows up to 255 characters on a line, so users with printers that can produce condensed characters will be able to pack more data into a line than I can. Those without such a printer will find the column- and page-move feature very useful.

The only shortcoming I found with Vis/Bridge/Report was its documentation. Like many user guides written by programmers, it has a few inconsistencies. None of these will interfere with correct use of the program, but they are annoying nevertheless.

Financial professionals, either in individual practice or within large corporations, will find Vis/Bridge/Report a practical and easy-to-use accessory for their Visicalc sessions.

Micromarkets

Micromarkets is a different kind of Visicalc tool. It is not a program but a set of four data files containing demographic data by state and population areas. These files certainly won't interest every Visicalc user, but market researchers and sales analysts will jump for joy.

The four Micromarkets files contain the sales and market analysis data found in tables published

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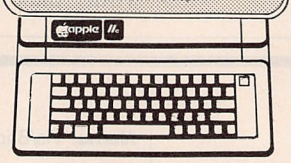

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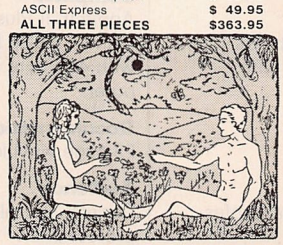

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semiannually in leading journals in the field. The big advantage here is time saving. Just imagine how long it would take someone to enter and verify 4520 data elements and 200-odd labels and headers, and the cost of a Micromarkets disk is easily justified.

Two of the files contain the following demographic information, broken down for each of the 50 states plus the District of Columbia and for the top 38 metropolitan areas: 1980 population; percentage of population growth between 1970 and 1980; number of households; median age; number of husband/wife families; number of husband/wife families with children; number of single-person households; black population; Hispanic population; number of households in the following income ranges: less than $10,000, $10,000–$14,999, $15,000–$19,999, $20,000–$24,999, $25,000–$34,999, more than $35,000; median household income; mean household income; population in the following age ranges (in years): 0–9, 10–19, 20–24, 25–34, 35–54, over 55; and number of owner-occupied units.

The other two files contain additional demographic and retail sales data, also by state and by largest metropolitan area: 1980 population; percentage growth in population between 1970 and 1980; number of households; median household income; number of owner-occupied units; total dollar value of retail trade; and retail sales by building materials outlets, general merchandising stores, food stores, auto dealers, gas stations, apparel stores, furniture stores, eating and drinking establishments, drugstores, and miscellaneous outlets.

Using the Micromarkets information in your own work sheets is very simple once you understand that the program provides just raw data and you must supply your own template layouts and operating values. The users manual, a cut above the others in graphic presentation, gives the following example of one possible use of the data.

If you wanted to measure market potential for a video-game program for microcomputers, you might want to create an index of the market in each of the 50 states. From your past experience you know your market is youngsters, so in a new column you enter a formula to divide each state's entry for the population between 10 and 19 years old by the total U.S. figures for this age bracket, obtaining a percentage per state. Then you repeat the procedure in a second column determining the percentage of 10- to 19-year-olds in households with incomes greater than $35,000. Your guess is that income is one-third as important as the population for determining market size.

In a third column, add two-thirds of the "population" percentage to one-third of the "income" percentage. The higher the number, the greater the market potential for sales in any given state. If your computer is running a little low on memory, you can simply delete the columns of data that aren't required in your analysis.

As I've said, the Micromarkets data isn't for everyone. But for people whose jobs or companies depend on good planning and accurate, meaningful forecasts, the Micromarkets disk is an invaluable time saver. □

At a Glance

Name: Mergecalc

Use
Performs arithmetic operations between Visicalc work sheets

Manufacturer
Micro Decision Systems
POB 1392
Pittsburgh, PA 15219
(412) 276-2387

Price
$125

Format
5¼-inch floppy disk

Computer
Apple II, II Plus, IIe, and III with 48K-byte RAM; IBM Personal Computer with 96K-byte RAM; one disk drive

Documentation
16-page booklet

Audience
Corporate planners and financial professionals

Name: Vis/Bridge/Report

Use
Report formatter for Visicalc work sheets

Manufacturer
Solutions Inc.
Box 989
Montpelier, VT 05602
(802) 229-0368

Price
$79 plus $4 handling

Format
5¼-inch floppy disk

Computer
Apple II, II Plus, IIe, and III with 48K-byte RAM; TRS-80 Models I, II, III, 12 and 16 with 48K-byte RAM; IBM Personal Computer

Documentation
28-page vinyl loose-leaf binder

Audience
General Visicalc users and accounting professionals

Name: Micromarkets

Use
Demographic and sales data files

Manufacturer
Orrington Economics Inc.
POB 3756
Arlington, VA 22203
(703) 527-5990

Price
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Format
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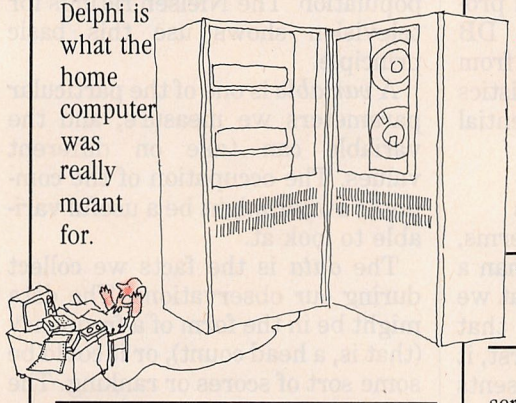

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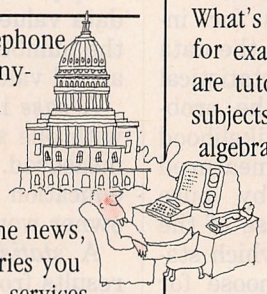

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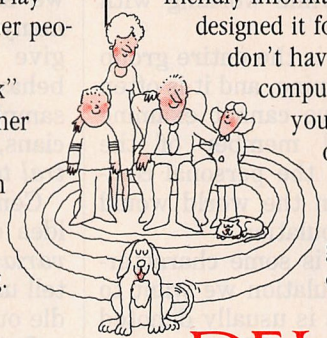

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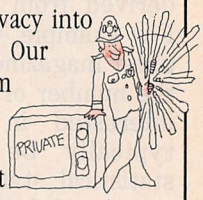

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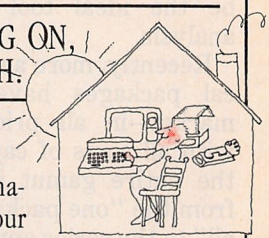

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HOME/BUSINESS

Statistical Software

A buyer's guide to seven major types of statistics packages

by Peter Callamaras

What does it mean to you if 1982 sales for Apple computers were up 75 percent or if wholesale prices of hogs rose 23 percent? The importance you place on either statement depends on whether you sell computers or fatten pigs for a living, but both are examples of the common statistical information we read every day.

When you think about it, most information we receive is either presented in statistical form or derived from statistical analysis. For example, the number of computer magazine readers relative to the number of people in the world interested in computers would typically be presented as a statistical statement such as "95 percent of those interested in computers read computer magazines."

Unfortunately, the idea seems to have been planted in many of us from the early days in school that statistics is something best left to mathematicians or those "odd sorts" who like to fool around with numbers. The good news, of course, is that because statistics involves so many numbers and formulas, the computer has proved to be the ideal tool for statistical analysis.

Recently, more and more statistical packages have entered the market—in all price ranges and with all sorts of capabilities. Now the entire gamut is represented, from the "one package that does it all" to the series approach that presents a family of programs from which you pick those programs with the statistical functions you need. In the best of these series packages, each of the stand-alone programs can use the data generated by any of the sister programs. Some can even use data generated by or entered into nonrelated programs, such as Visicalc or DB Master. The options range from fairly routine descriptive statistics all the way up to inferential statistics.

Peter Callamaras is working toward a graduate degree in systems management at the Air Force Institute of Technology, Wright-Patterson AFB.

A Micro Course in Statistics

Reduced to its simplest terms, statistics is a nothing more than a collection of facts, or data, that we convert into information that serves two basic functions. First, it describes something and presents the description in a convenient, usable, and understandable form. Second, the information enables us to make generalizations (or inferences) about the group the data was gathered on. A statistical analysis also measures the probability of the data, or the likelihood that the results we measured would have occurred by pure chance alone. The final use of the information determines which statistical techniques we choose for analyzing the data.

As with any other human endeavor, statistics has a special jargon we need to be familiar with. You may run into many of the following terms while working with statistics:

A *population* is the entire group we want to examine, and it is often so large that we cannot examine each individual member of the group. Thus all the personal computer owners in the world would constitute a population.

A *parameter* is some characteristic of the population we want to measure, and it is usually denoted with a Greek letter. In our example, the proportion of Apple computer owners might represent one of our population parameters.

A *sample* is a portion of the population that we measure, and we choose a sample so it mirrors the parent population as closely as possible. Thus all Apple computer owners in the western half of the United States might be our sample. We use the information about our sample to determine something about a much larger population The Nielsen ratings for television shows use this basic principle.

A *variable* is one of the particular parameters we measure, and the variable can take on different values. The occupation of the computer owner might be a useful variable to look at.

The *data* is the facts we collect during our observations. The data might be in the form of a frequency (that is, a head count), or it could be some sort of scores or ranking. The data can also be *grouped* or *ungrouped.* Ungrouped data is simply a listing of all the actual data values. Grouped data tells us the number of cases with the same actual value.

A *case* is all the data associated with one specific parameter being measured. The age, income level, education level, and so on for one owner would make up one case.

A *statistic* is the number that results from manipulating the raw data according to some specified procedure.

The *mean* is the arithmetic average of our measurements and is the most typical statistical value we see. The mean is one of the many descriptive statistics that give us an idea about typical behavior or performance of our sample. In the world of statisticians, the mean is a measure of *central tendency.*

Central tendency gives us an idea of where the middle is. The *variance* and *standard deviation* tell us how far away from the middle our statistics are.

Paired measurements involve two or more scores for each case (income and age, for example). We can display our statistics in one

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table using rows and columns; this kind of table is called a *contingency table* or *cross-tab* format. *Correlation coefficients* tell us how our measurements relate to each other, such as increasing together, decreasing together, or acting independently. To tell whether something occurred simply by pure chance, we attach a *probability* to our information. Probability measurements are varied and are usually followed by the word "test" (for instance, a *t*-test or an *f*-test). Usually we set a limit on how much chance we attach to some occurrence and set the probability at or below 5 percent.

Finally, we want to know something about the *distribution* of our sample, or the dispersion of our measurements about one central point. In a *normal distribution* we expect most of our data points to lie on the middle line and those points that fall off the middle line to be equally distributed on either side of the middle. The values on the right are positive, and those on the left are negative. The statistical tests on normal distributions are called *parametric* tests. Any other distribution requires us to use *nonparametric* techniques.

Picking the Right Package

When it comes to choosing a statistical package, the first rule is to determine exactly what types of statistical analysis you'll need. Naturally, a casual user has different requirements than a full-time researcher. Casual users will probably be happy with a full set of descriptive statistics and some sort of relational analysis. Researchers, on the other hand, will probably want as comprehensive a set of tools as they can find.

All of the programs offer a variety of statistical tools, and every user should find one of these packages satisfactory. Base your decision not on price but on your particular needs. The Contents section in the At a Glance box for each program provides a short synopsis of the features that each program offers. Take your time and examine the packages closely. Before purchasing a package, try it out on data that is familiar to you and whose results you know ahead of time. See if the program gives you acceptable results, and see if you're comfortable actually working with the program.

The computational accuracy of all the following programs was satisfactory, but using an 8-bit microcomputer for analysis does have limitations. If you use large numbers, you can lose some accuracy at the lower decimal places on some tests. For instance, an 8-bit system might report 79.387 as 79.395. The programs I examined didn't seem to have any serious problems in the higher decimal places (that is, 79.3), but when I ran several of the multiple-regression tests, I did get inaccuracies.

I am not a statistician, but like many of us today, I need to perform many types of analysis on a large range of data. I have used mainframe statistical packages, and the microcomputer packages reviewed here all compare favorably for most of my requirements. It's not often I need the accuracy of 5-plus decimal points that the mainframe packages offer. I found I could actually do more and work faster at home with the microcomputer-based packages because I didn't have to schedule inputs, time-share, or wait for printed outputs. For more than 90 percent of your statistical needs, one or more of the seven packages presented here should fill the bill.

1. Edu-Ware Statistics 3.0

Statistics 3.0 from Edu-Ware Services Inc. is the least expensive package reviewed here, but don't let the price fool you. At $29.95, this program gives you a practical set of basic statistical tools.

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The Statistics 3.0 package includes six different statistical procedures, as well as a data-editing facility and a disk-storage capability. Because the entire program is menu driven, you should have no trouble moving between the various modules as you perform your analysis. The documentation is somewhat sparse but gives you a cursory explanation of each module. Unfortunately, the documentation assumes that anyone wanting to use this package has a basic understanding of statistics and knows what he wants to accomplish, as well as which of the program's modules will provide the preferred statistical tool.

The program offers two ways to enter data: either from a previously prepared data disk or from the keyboard. Data entry goes smoothly, but you must pause for a fraction of a second after entering data from the keyboard. Otherwise, you'll input the next data point before the program is ready to accept it, which can cause some rather bizarre results. For instance, while you might think you have entered 235, the program might have accepted only 35. This point is minor, though, and the best way to slow yourself down is to check the data entry before hitting the return key.

Entering data from a disk is also simple, but unfortunately you can store data only on the program disk itself. There are no provisions for storing data on separate data disks. The number and size of the data files you can save are limited. When the disk is full, your only choice is to delete a file to give yourself more room. You can catalog the files on the disk but only if you actually exit the program.

Computationally, Statistics 3.0 performs quite well. I ran each program module, and all the results agreed with the expected values. Naturally, some round-off differences occurred because the precision of the Apple is hardly what you get from a mainframe. But the differences are academic, considering the low cost and convenience of being able to do the work at home.

You will probably use the module on descriptive statistics most often to get mean, variance, and standard-deviation values. Most users will want to use the population rather than the sample statistics. You also have a choice of grouped or ungrouped data. Once you get past the descriptive statistics, you start to get into more specialized areas. The other modules enable you to work with probability and distributions. They include the Pearson product moment correlation, normal distribution, chi-square distribution, chi-square test, and the *t*-test.

The Pearson product moment correlation lets you calculate the correlation between two sets of paired measurements. The documentation gives you some typical examples.

The normal distribution lets you calculate both the probability and percentile values from the standard deviation and the mean you input. You can also use this module to compute a *Z* value.

Once you calculate the chi-square value and the degrees of freedom using the chi-square-test module, you can then get the probability of that value from the chi-square-distribution module. You can also calculate the distribution if you have previously used a contingency table to get the required input values to figure the distribution. There is no way for you to specify the expected values because they are given to you as part of the program's output.

Statistics 3.0 is a good statistical package for someone who needs nothing more than a basic set of statistical tools. The program is probably best suited for students

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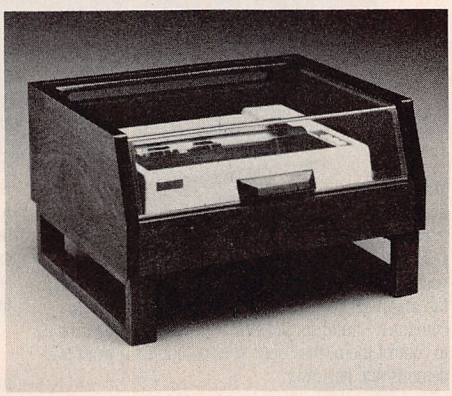

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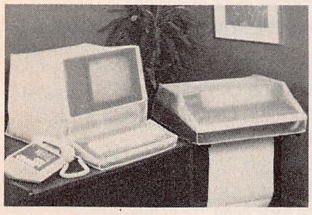

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or teachers who need to do some statistical work at home. Those in the behavioral or social sciences will appreciate the ease of getting statistical probabilities for smaller projects.

2. Financial Planning

Every time we turn around, it seems that someone is bringing out a new set of Visicalc templates. The ESI Mind Tool Series from Howard W. Sams joins the crowd with a sophisticated set of templates called Financial Planning for Visicalc and the Apple II. What makes this package different is the variety of financial planning and analysis tools it gives you.

This package includes a pair of statistical templates that enable you to get both the standard descriptive statistics (mean, variance, and standard deviation) and some idea of the relatedness of two data sets by means of linear regression.

Once you have Visicalc running, you simply bring in one of the two templates and start entering your data. The manual does an outstanding job of helping you get started. It includes a short description of how the templates work, a brief tutorial exercise, and finally, some helpful hints on using the templates. Besides the manual, you also get a quick reference guide.

After you enter all your data and obtain your results, you save them on the disk as you would save any other Visicalc data. The advantage of this program is the ability to use it with data previously saved or brought in as a DIF (Data Interchange Format) file from another source.

The computational functions are quite satisfactory, and I had no trouble using either of the two statistical templates. The accuracy is good enough for general use. Overall, this package is very convenient and a must for any business that uses Visicalc. The statistical templates are so easy to use that you might want to buy the package for these two templates alone. All the other templates are business oriented and will certainly be of value to many users.

3. Speedstat

Speedstat Volume 1: Basic Business Statistics is the first offering from Softcorp International, and it is indeed an auspicious beginning. Even someone relatively inexperienced in performing statistical analysis should have no problem becoming productive within the first few hours of using the Speedstat package.

The users manual is one of the best I've seen, regardless of the application. It takes you through all the various modules, explaining as well as demonstrating every aspect of the program's operation. Typical screens are shown to make things as easy for you as possible. The manual also shows samples of typical output reports, so you should have no problem getting a hard copy of whatever you want.

All functions of the program are menu driven, and you move between data entry, manipulating, saving, printing, and choice of statistical analysis with great ease. I had no trouble getting accurate outputs after about 30 minutes of reading and following the tutorials. I do recommend that you read the appendixes, though, because on occasion you might need to know the limit of using only two characters for a variable value.

You work with data in a rectangular table in which the columns contain the variable values and the rows contain the cases. The table is clearly explained in the manual. Speedstat also handles missing values. Because you will frequently have missing values, this feature is indeed worthwhile.

As you work with the program, you'll soon discover that the real secret to comprehensive analysis is how carefully you design the case

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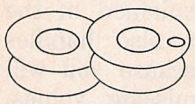

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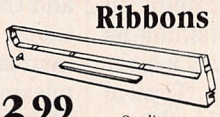

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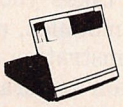

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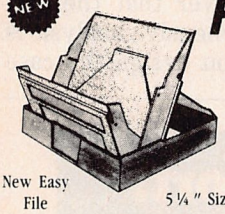

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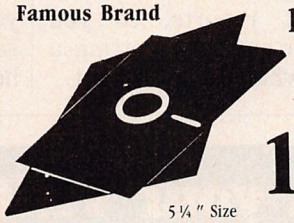

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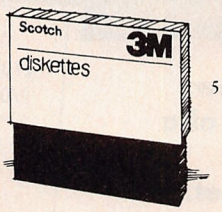

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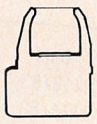

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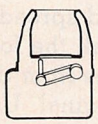

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layout in the initial stages of your work. Fortunately, the tutorial goes into quite a bit of detail to ensure that you'll waste as little time as possible in setting up your analysis design properly. You work with a simulated statistical study, entering and manipulating the sample data to get a report based on the study.

The heart of the program is the statistics section, which you use once you have designed your case and entered the data. The data can be integer, alphanumeric, or decimal, and you perform your statistical analysis on the entire data set at once. A limited number of data points can be entered at one time. The appendixes go into great detail on the different formats available, precision, type of data you can work with, and so forth. One of the most important appendixes contains the formulas used by the package for its statistical analysis. You are also given a set of references should you want to know where the particular algorithms came from.

The most recent upgrade to the program lets you use data from other programs, such as Visicalc or DB Master, via the DIF conventions established by Software Arts. This added flexibility means that people who currently use programs capable of generating DIF files can now perform additional analysis on their existing data.

An often overlooked feature of a program like Speedstat is the ability to use it as a specific type of database-management system. You can set up data sets as a continuing database, then add to or delete from it as the occasion dictates, and perform a continuing analysis over extended periods of time. For instance, a teacher might want to track test scores on a series of classes to determine the change in performance levels over time or even the suitability of a standardized test over time. Naturally, those using the program in a business setting will want to have as extensive a database for their

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decision making as they can, and using the program as a statistical database can be of great value in that respect.

Speedstat Volume 1 should prove to be one of the leading statistical packages. The program's authors have gone to great lengths to make the user productive with a minimum of effort. Softcorp has indeed started off on the right foot with its first package, and I for one can't wait until the entire series is available.

For Experienced Users Only

Now let's look at programs designed for more statistically sophisticated users. This is not to say a novice cannot use these packages, but most of them assume the user is fairly familiar with the statistical tools offered by the particular package. Potential users of the following packages should look closely at the different functions and statistical techniques each package provides. On one hand, all these programs give you the more common analytical tools, such as descriptive statistics, but then they diverge on some of the more specialized procedures offered. Determine your particular needs or favorite procedures and then check each package to see if it contains the procedures you are most comfortable with or the ones you need.

One other comment: Potential users should also check the reference section of all the packages. Most of the more sophisticated programs give you references to the source of the particular algorithms they use, and in some cases, such references may be the deciding factor on the suitability of a specific package.

4. Statistics with DAISY

Here's another case where you shouldn't let the price of the package fool you. At $79.95, Statistics with DAISY (Data Analysis and Interactive Statistics) is a relatively inexpensive but powerful statistical package. Students in particular will find it very attractive.

One of the first things that strikes you is the program's ease of use. The manual does a nice job of leading you through the various modules of the package and is written in a light, breezy style. At first glance the manual may seem small, but it does give you all the basic information. A help facility is available in each of the program's modules if you need assistance. You can also get a display of all the available commands in each module.

The first time you use the program you configure it to your own computer system. After that, you configure the program only when you change your computer system by adding a second drive, changing printer slots, and so on. Basically, the package handles all your data in a rectangular table. You enter your variables in the columns with each variable's data contained in its corresponding row—thus the program's convention of calling variables "columns" and observations "rows." Each row, then, must have a corresponding column. You can also vary your column-to-row ratios.

You can enter data from either the keyboard or a data disk. You also have the option of using data from other programs in the form of DIF files. These files can come from a number of sources, thus giving business users an added dimension if they currently use any products capable of creating DIF files. You can also save your DAISY files as DIF files and use them later as a source of information for other programs.

During your analysis, you can view your results as a pictorial representation. When you get a plot or histogram, you may save it on a disk for later printing or print it

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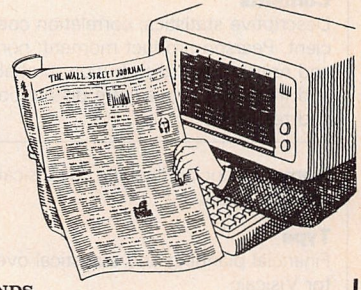

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At a Glance

Name: Statistics 3.0

Type
Statistical package

Manufacturer
Edu-Ware Services Inc.
POB 22222
Agoura, CA 91301
(213) 706-0661

Price
$29.95

Format
5¼-inch floppy disk (copy-protected)

Computer
Apple II, II Plus, and IIe with 48K-byte random-access memory (RAM), Applesoft, single disk drive, and DOS (disk operating system) 3.3

Documentation
19-page manual with glossary

Audience
Researchers or students who perform general statistical procedures with small sets of data or anyone who wants an inexpensive package for descriptive statistics

Contents
Descriptive statistics; correlation coefficient, Pearson product moment; normal and nonstandard distribution, probability, and frequency; chi-square distribution and test; *t*-test

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Name: Financial Planning for Visicalc and the Apple II

Type
Financial planning and statistical overlays for Visicalc

Manufacturer
Howard W. Sams and Company Inc.
ESI Mind Tool Series
Expert Systems Inc.
4300 West 62nd St.
Indianapolis, IN 46268
(317) 298-5400

Price
$69.95

Format
5¼-inch floppy disk (not copy-protected)

Computer
Apple II, II Plus, and IIe with 64K-byte RAM, one disk drive, DOS 3.3, and Visicalc; also available for the IBM PC and TRS-80 Models II and 12; additional versions available for Multiplan and Supercalc

Documentation
Approximately 200-page loose-leaf binder, including tutorial, sample data, and quick reference guide

Audience
Anyone who uses Visicalc and wants a set of standard statistical descriptive and correlation tools

Contents
Descriptive statistics; regression; compound growth; annuities; discounted cash flows; profit planning tools; real estate finance

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Name: Speedstat Volume 1: Basic Business Statistics

Type
Statistical analysis tool

Manufacturer
Softcorp International
229 Huber Village Blvd.
Westerville, OH 43081
(614) 890-2820 or (800) 543-1350

Price
$249; $20 for backup disk

Format
5¼-inch floppy disk (copy-protected)

Computer
Apple II, II Plus, and IIe with 48K-byte RAM, two disk drives, DOS 3.3, and printer

Documentation
Tabbed users manual with tutorial

Audience
Anyone needing basic descriptive statistical analysis capability; first in a comprehensive series of statistical analysis tools

Contents
Descriptive statistics; standard error; estimate of population and sample standard deviation; estimate of population variance; missing values; number of valid cases; two-way and end-way cross-tabs; chi-square; Cramer's V; lambda; gamma; Somer's *D*; contingency coefficient *C*; Kendall's tau *C*; Spearman's rho; correlation, Pearson product moment

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Name: Statistics with DAISY

Type
Statistical package

Manufacturer
Rainbow Computing Inc.
9719 Reseda Blvd.
Northridge, CA 91324
(213) 349-5560

Price
$79.95

Format
5¼-inch floppy disk (not copy-protected)

Computer
Apple II, II Plus, and IIe with 48K-byte RAM, one disk drive, and DOS 3.3

Documentation
50-page manual

Audience
Anyone with statistical experience who needs a well-rounded statistical package

Contents
Descriptive statistics; correlation, covariance, partial correlation, autocorrelation; Spearman's rho; Kendall's tau; chi-square; *t*-test; ANOVA, one- and two-way; Cochran *Q*-test; Mann-Whitney *U*-test; Friedman two-way ANOVA; regression, simple linear and multiple, forward and backward, step sweep variance in or out, Durbin-Watson, betas

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Name: Stats Plus, ANOVA II, and Regress II

Type
Series of statistical packages

Manufacturer
Human Systems Dynamics
9010 Reseda Blvd., Suite 222
Northridge, CA 91324
(213) 993-8536

Price
$200 for Stats Plus; $150 for ANOVA II; $150 for Regress II

Format
5¼-inch floppy disks with backups (copy-protected)

Computer
Apple II, II Plus, IIe, and III in emulation mode with 48K-byte RAM, one or two disk drives, DOS 3.3, and Applesoft in read-only memory

Documentation
96-page manual for Stats Plus; 52-page manual for ANOVA II; 83-page manual for Regress II

Audience
Experienced students, researchers, or others who need a single overall statistical package or packages for ANOVA or regression analysis

Contents
Stats Plus
Descriptive statistics; chi-square; Fisher extract; signed ranks; *U*-test; Kruskal-Wallis; Friedman two-way ANOVA; ANOVA, one- and two-way; Kendall's tau; Spearman's rho; partial correlation; multiple regression; *t*-tests

ANOVA II
Covariance; repeated measures; split-plot designs; 1-5 factors, 2-36 levels; descrip-

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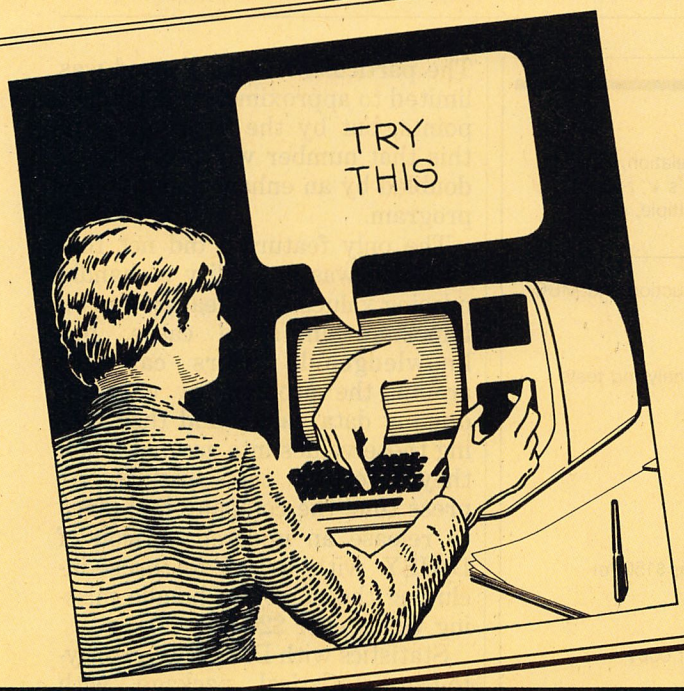

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At a Glance CONTINUED

tive statistics; equal/unequal *N*; ANOVA table; marginal means; cell sums of squares

Regress II
Multiple regression; 25 variables, 300 cases per variable maximum; correlation matrices; descriptive statistics; regression on any subset, any order of variables; case *X* case, variable *X* variable input

Name: Maxistat

Type
Statistical package for TRS-80s

Manufacturer
Adventure International
Business Division
POB 3435
Longwood, FL 32750
(305) 862-6917

Price
$199.95

Format
Three 5¼-inch floppy disks
(not copy-protected)

Computer
TRS-80 Model I or III, one disk drive; contains DOSPLUS operating system and can be converted to others

Documentation
Comprehensive 86-page manual with indexes and tabs

Audience
Users who are interested in a comprehensive set of statistical analysis tools and have some knowledge of TRS-80s and BASIC

Contents
Descriptive statistics; confidence intervals; chi-square; correlation, Pearson product moment; Cramer's *V*; *t*-test; regression, linear and multiple; cross-tabs; ANOVA

Name: MBC Test Construction and MBC Correlation

Type
Statistical packages for analyzing tests

Manufacturer
Moore-Barnes Company
POB 517
Roseburg, OR 97470
(503) 673-0345

Price
$70 for Test Construction; $150 for Correlation

Format
5¼-inch floppy disks (not copy-protected)

Computer
Apple II, II Plus and IIe with 48K-byte RAM, one disk drive, and DOS 3.3

Documentation
17- and 45-page manuals, respectively

Audience
Sophisticated users interested in analyzing test answers

Contents
Descriptive statistics; Chronbach's alpha; correlation, Pearson product moment; items, number, difficulty, variance, criterion correlation, *N*, total number answered, test score; total score variance; *t*, *z*, and *p* values; Spearman's rho; Kendall's tau; Goodman-Kruskal; rank ordering; biserial, biserial point, phi, tetrachoric

out immediately. A built-in conversion routine converts your DAISY files to Apple Plot files if you happen to have the latter available. This routine can be handy for preparing presentation-quality graphics for your analysis. If you do not have the ability to print graphics directly from the program, you can exit the program, print the picture, and then reenter the program with a simple Call statement. I found this feature handy because I could compare the results I obtained with the DAISY package to those I got with other programs as well as with my reference statistics. You can also get a complete report printed out; a set of report commands is available just for this purpose. I appreciated the built-in ability to handle the escape sequences required by many printers. It simplified getting my reports out. Computationally, the package met all my needs for graduate-level statistical analysis.

For those who might want to add a feature or two, the manual also gives you the basic information needed to extend your use of the program and to examine or change your variables. You are also given the assorted technical details of how your information and data are stored and used by the program. The particular version I used was limited to approximately 3000 data points, but by the time you read this that number will probably be doubled by an enhancement to the program.

The only feature I did not find available was an ability to handle missing values. This feature can be important in some cases, but knowledgeable users can get around the problem by entering dummy data values and then taking these values into account when they interpret their results. At press time the company had plans to release an updated version of DAISY with added features—including the ability to handle missing values—for $200.

Statistics with DAISY is an easy-to-use statistical package with broad appeal. Anyone needing the particular analytical tools offered in this package should be pleased with the entire package, especially the price-performance ratio.

5. Human Systems Dynamics

Three statistical packages—Stats Plus, ANOVA II, and Regress II—are currently available from Human Systems Dynamics. Together they form one of the most comprehensive statistical analysis systems on the market today.

All three packages assume you have a background in statistical fundamentals and that you know the best analytical tool to use among the wide array at your disposal with this series. The manuals are terse, giving you just the bare essentials for operating the programs. You get a very short example of what some input and output looks like, but the manuals include no tutorials.

Fortunately, the programs are easy to use. All are menu driven and share a common data-storage system. Once you enter data and then save it on a disk, any of the programs can analyze that data. To enter data, you first describe its format and give it a disk file name before entering the data points. Data entry follows the same con-

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In plain English. You won't have to learn a cryptic language to use Multiplan. It takes commands in plain English. And, it will prompt you as you go along by telling you what to do next. There's even a HELP key in case you need help at any point. Press it and it gives you information to get you going again.

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ventions in all three packages, so if you use one, you'll be comfortable with the others.

An extensive array of transformations on the data is available, including multiplication by a constant, exponentiation, ranking, operations on files and fields, and others. You can save the data in either sequential files or random-access files. Each file type has its benefits depending on the analysis you want to perform. However, you can also convert one type to the other. Computationally, I obtained consistent results and encountered no problems as I worked with the packages.

The programs offer you a choice of outputs. You can send output to the screen or printer or to both as you want. At any point you can obtain a printed output, such as a copy of your data or the results of computations.

The Stats Plus package contains the fundamental statistical tools most users need. In fact, if I could have only one of the three packages, it would be Stats Plus. Program modules include descriptive statistics, correlation, linear and multiple regression, ANOVA and *t*-tests, cross-tabs, and others.

The ANOVA II program will appeal to those who need more in the area of variance analysis. The manual gives you an explanation of the terminology used by ANOVA II. This feature can be a real time-saver, eliminating some of the confusion that often comes from terminology differences between disciplines.

ANOVA II offers you three types of variance analysis: randomized designs, factorial designs, and between-within (split-plot) designs. You can also select equal or unequal sample sizes in the randomized and between-within designs. The program uses an unweighted means analysis on the randomized and between-within designs.

Regress II, the third offering, is a multiple-regression package. It follows the standard data-entry

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and manipulation conventions. As with the other programs, you can enter data from the keyboard or from a disk file. The latter can come either from the data-entry module in the Regress package or from one of the other two packages. However, Regress works only on sequential files and requires that you convert any random-access file to sequential.

The package can handle a maximum of 25 variables, with up to 300 cases per variable. This capacity should meet most users' needs. The package does not handle missing values, however.

Overall, the Regress package is easy to use. My only complaint is that you must set up the module each time you start up the program. However, that's a small price to pay for the results the package gives you.

The three statistical packages offered by Human Systems Dynamics form a powerful set of statistical tools. If you were to have just one, then Stats Plus with its overall statistical programs would be the choice, but if you need more power and flexibility in either analysis of variance or regression, then ANOVA II for the former or Regress II should be added.

6. Maxistat

Maxistat, from the Maxiseries produced by Adventure International's Business Division, is a statistical offering for owners of TRS-80 Models I and III microcomputers. This package is definitely not intended for novices. Judging from the source code (which is not at all well documented), anyone contemplating modifications will have to work hard at it. However, the package does include a good summary of all the procedures.

It's an understatement to say that Maxistat is not primarily intended for doing a quick-and-dirty analysis and takes a while to both set up and process. Indeed, at times the package is downright unwieldy. It uses many disk routines, file conversions, and so forth. And all combine to slow things down. If you make a mistake while entering your data, you have to start over from the beginning—a painful process if you're working with a large data set. The author of the program even recommends that you turn on the machine and go to bed for analysis of a large set of data.

Furthermore, the program makes assorted assumptions that it fails to tell the statistician about, which could cause problems when it comes to interpreting the results. For instance, instead of using the usual biased estimator (N-1) to calculate parameters, the program uses unbiased estimators which are normally used only when the population is not known. Com-

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putationally, a couple of minor errors occurred in the ANOVA and multiple linear-regression options.

On the plus side, the program handles both free-field and fixed-format data as well as alpha data. Because the program is written in BASIC, you can make changes as you see the need. The package handles just about any type of data collection or analysis file you might come up with. However, this versatility probably contributes to the slowness of the programs. Also, the program sends output only to a printer, so don't expect to see any screen displays of your final analysis results.

Maxistat is a slow statistical package. It does, however, contain a large repertoire of analysis techniques and handles almost any type of file you might need.

7. Moore-Barnes

Moore-Barnes currently offers two packages for statistical analysis: MBC Test Construction and MBC Correlation.

The Test Construction package is intended for those who are basically interested in analyzing test answers. These tests can use either a Likert-scale or multiple-choice format, with true-false considered a type of multiple choice. The user builds a data file consisting of the answers to the tests and then performs a series of statistical analysis on the resulting data.

The Correlation package consists of a series of different correlation programs that let you analyze data collected and entered as a series of data files. You can also perform the normal descriptive statistics on your data, including a frequency distribution plot.

Both programs contain a data-entry module and a module corresponding to each of the analyses you want to perform. In the Test Construction package, you can remove questions and answers and perform your analysis to see how the results vary. For example, an instructor can look at students' responses to questions and then throw out those that a substantial number of students have missed. After all, there are occasions when a "bad" question is asked on a test.

The Correlation program is easy enough to use, but you must tell it quite a bit about what you did and what you want to know.

Both programs are menu driven. In several cases, however, you can do only one activity, such as data entry, at a time because you cannot complete the activity and then go to another without rebooting the program disk. When I was trying to enter several specific, limited data sets to test the computational capabilities of the programs, I often found it disconcerting to restart from scratch after finishing one activity. Because the programs are unlocked and written in BASIC, it should be relatively simple to add your own routine to return to the main menu. You might expect the programs to be on the slow side because they are written in BASIC. However, I found the time they took to perform computations acceptable and the results accurate.

The two offerings from Moore-Barnes, particularly the Test Construction package, are targeted to the sophisticated user. However, once you work with them for a while, they do become easier to use. I particularly liked the descriptive statistics section of the Correlation package. □

EDUCATION

Probing the Search Series

Classroom simulations that help children challenge each other

by Peter Owens

Over in the corner a cluster of fifth graders argued vehemently.

"That's dumb," said one girl.

"It *is not*," snorted one of her male partners. "We need to do forestry research because we need more wood."

"No, no, no," countered another, "the logger's fund—that's where we should put our money."

Suddenly their corporate name, Sungo, flashed across the computer screen. Sungo's corporate rivals, members of Enerco, called out "Sungo's turn," twirled away from the computer, and bolted to their own corner of the room. The Sungo team quickly gathered up its corporate papers—charts, graphs, computations—and rushed over to the Apple II that Enerco's four directors had just vacated.

Almost as if it had overheard the very substance of Sungo's argument in the corner, the computer fired off a series of pointed questions, flashing bits of pertinent data, reading out progress reports, spewing out so much data that Sungo's directors each had to take responsibility for only a portion of the information on the screen. Their division of labor already well established, all four directors took notes as the computer pressed them for decisions. Shall it be the logger's fund or forestry research? the computer asked. Its cursor flashed back and forth between options as if to say, "Make up your minds; think hard and fast. Your corporate destiny is on the line."

In controlled whispers, a consensus formed: "Logger's fund. No, forestry research. Logger's fund. Yeah, logger's. No, research. No, logger's. Yeah, logger's. Okay, logger's." Out flashed a finger to press the space bar: enter logger's fund. The computer swallowed the

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new decision, then asked how much they wanted to spend. And so it went for another minute or so. Then it was Camco's turn at the screen, and the Sungo team members rushed to their corner to share notes and digest the implications of their decisions.

Learning to Think

Charged with excitement and only a step or two ahead of chaos, this sort of cerebral high rolling is what teachers love to see. It means students are learning how to think, and when students can think, they can learn anything. In the world of thought, all facts have places to go, and when a fact has a place to go—when it fits an idea—it will curl up and stay a long time. But when facts don't have ideas to snuggle up to, student minds wander, and the facts get transformed into paper airplanes and wads of bubble gum, launched and stuck in all kinds of places they don't belong.

The moving force behind these fast-paced minicorporate dramas is a software package called Energy Search, one of five educational simulation games in the Search Series, a group of programs designed by Thomas F. F. Snyder, an unconventional 10-year veteran teacher at the Shady Hill School in Cambridge, Massachusetts. Published by McGraw-Hill, the Search Series is a far cry from traditional educational software, most of which is old-fashioned tutorial drill fancied up with some computerized razzle-dazzle but drill nonetheless and thus limited in important ways.

What makes the Search Series (with simulations in geography, geology, archeology, energy, and community affairs) interesting and worthy of careful scrutiny is that it finds ways for kids to teach and challenge each other. It provides temporary relief from a glaring problem that research has discovered in most classrooms: the teacher talks too much to everyone and not enough to anyone. Like a well-trained and restrained teaching assistant or aide, a Search program occupies groups of students both on line and off line, thus freeing the teacher to circulate and offer tips, cues, advice, analysis, or whatever pertinent content he or she wants to add to the simulation game's built-in curriculum.

You might expect that the Search Series is loaded with flashy graphics, jingles, melodies, and bursts of color. It isn't. It is almost all text and is as quiet as a mouse. Its power is that it creates a simulated environment most of whose drama is actually spawned in the imaginations of the players. The computer provides numbers and situational choices, calculates the implications of decisions, and

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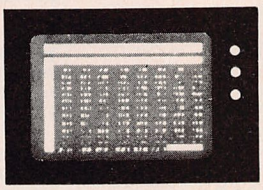

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generates an ongoing file for each team, keeping track of each change and assigning a profit or loss report for each turn at the computer.

Computerized Field Trips

Snyder, who began working on the idea four years ago, equates the simulations with educational field trips, but unlike many such excursions where students are passive observers, here students participate in running a corporation (energy), sailing and navigating the oceans in a Columbus-like voyage to the New World (geography), searching and drilling for oil (geology), constructing a new social order after forced migration from an ancient society (community), and generating theories about the origins of an ancient people through excavation of a historic site (archeology).

The series does what simulations do well: it provides interactive hands-on experience in situations that are either too dangerous, expensive, complex, or inaccessible for students in a learning environment. It does what no teacher can do by keeping track of the increasingly complex consequences of student choices. And it does what no textbook can do by reacting flexibly to new information and generating new possibilities.

Equally important, however, is the series's attempt to address the realities of computer-aided instruction in today's schools. The programs require only one computer for groups of up to 25 or 30 students. The series demands no computer training for either teachers or students and hinges on classroom organizational methods that most teachers know quite well, notably small-group activity using workbooks, pencils, and paper. The programs require that students take notes, fill in graphs, and record their decisions and the results of those decisions in order to make progress.

Each simulation offers a demonstration that quickly establishes the routines of the game and shows teachers and students what happens on the screen. Armed with clear and easily digested documentation and workbooks, a teacher can catch the drift of the game in only 10 or 15 minutes of fiddling at the keyboard. A teacher need not fully master the game before asking students to begin. The best way to learn, in fact, is to watch four or five teams embark. Within minutes each takes off in a different direction and gradually develops a unique set of strategies, even a game philosophy. There are no right or wrong answers; each team follows its own logically consistent course and will act either wisely or unwisely within the terms of its own evolving strategy.

Thus when students turn to Snyder to ask, "What can we do now?" his answers are necessarily tentative: "Why don't you try going back to water power, and maybe you can recoup your losses from oil?" or "Maybe you should invest in energy research; that will give you more options and help everyone." Teaching the series is really very easy; for many teachers the greatest challenge may be keeping quiet and letting students think their own way through.

The Price of Progress

Although primarily a game of logic and decision making, Energy Search is strongly influenced by the personalities and thinking styles of its players and is therefore fascinating to watch. A team that is spirited and prone to speculation quickly ends up wrestling with high-risk, cash-intensive decisions that arise from the players' impulsive style. On the other hand, a more cautious, conservative team quickly finds itself grappling with economic strangulation. Its safe, low-profit operations stagnate while the high-rolling team rocks from the busts and booms of big-bucks speculation. Nicely accommodated by the program, these human dimensions are just as instructive as the logic and calculations. After students take only three or four turns at the computer, these dynamics take shape and force students to adjust to the weaknesses of their thinking styles while at the same time letting them think within their own terms.

For a sense of how this process happens during the game, let's look back at Sungo's initial dilemma—whether to invest in research or in the more immediate concerns connected with logging operations. Sungo started its operations using oxen power whose associated problems involved grain production, shelter, and disease. Having moved on to direct a factory fueled by wood and powered by steam, Sungo has many immediate needs. If Sungo does not keep its supply of wood coming along good roads, the factory will shut down for an entire turn, and the company will lose money. Yet by investing in research, Sungo might eventually secure more modern technology such as water power, coal, oil, or nuclear power.

Impressed by new technology, Sungo opts for research, not yet knowing that the price of progress may be higher costs as well as higher profits. Water power, for instance, offers bigger money but also bigger complications—a company must wrestle with turbine technology and dam projects, and corporate life grows trickier. Later reliance on nonrenewable fuels will lead to even higher costs for raw materials, machinery, skilled labor, and pollution violations. In the distant future, solar power beckons.

Enerco, the shrewdest of the eight teams, masterminded a tough, fiscally stingy strategy. They watched other teams charge headlong into new technologies. When Enerco's most outspoken leader was pressed by his team to opt for new technologies, he observed, "It takes a lot of bucks to stay in coal. People are making a *lot* of money in water. Let's stay with water, and you'll see."

His company stayed with water power and distributed its cash frugally, maintaining a tight

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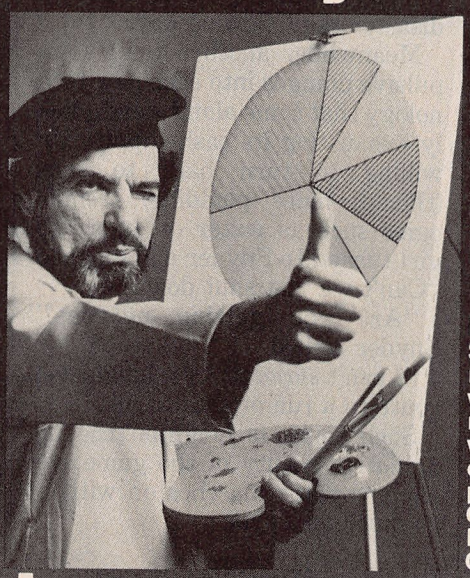

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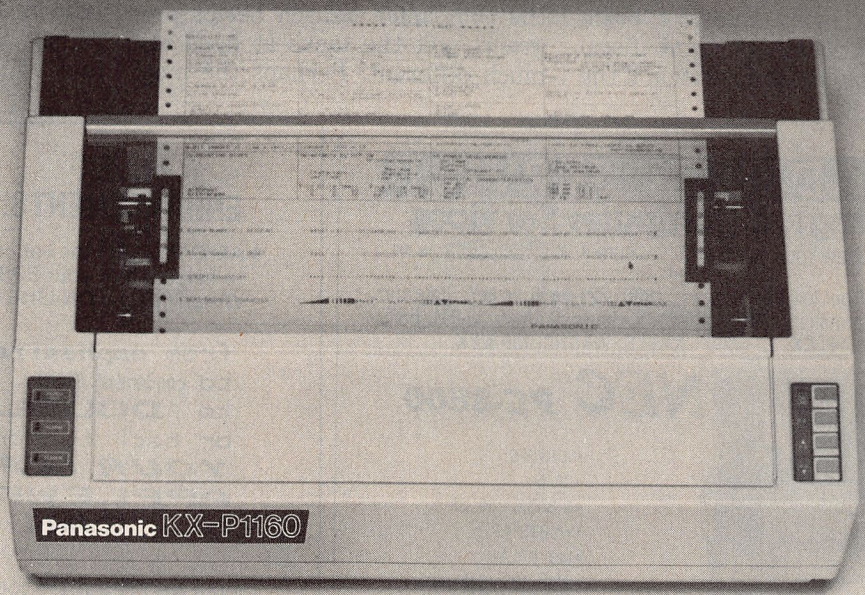

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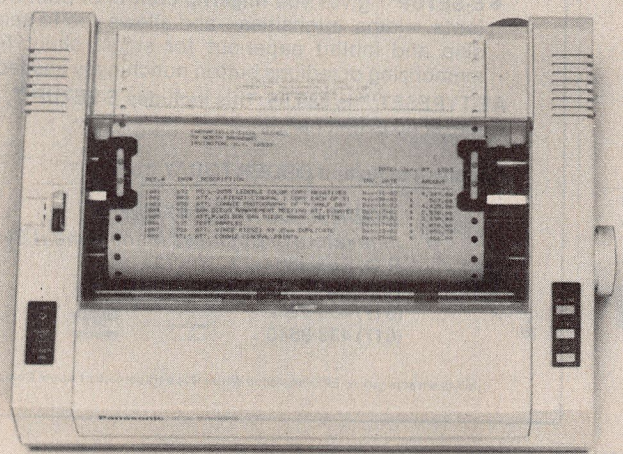

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balance among all the funds and expenses the water power required. Soon the company was turning steady profits. Its leader grinned with miserly delight, "We've got cash galore!" But the balanced tight-fisted spending policy also threatened account shortfalls three or four turns into the future. Several equipment funds were growing dangerously low, and if just one account in equipment or operations shrinks to nothing, a company must shut down and can pay back each delinquent account only one turn at a time. Thus the game forces teams to plan ahead and invest enough in each account to keep it solvent for several turns at the keyboard.

While Enerco's was a smart strategy on several grounds, it was risky on others, and when the class period was over, Enerco's brain trust knew that its tight fiscal policy needed radical revision if the company was to avert financial disaster the following day.

Meanwhile, another team's impulsive plunges into each new technology that came along were quickly exhausting its cash supply. Unwilling to turn back to safer (though more plodding) technologies such as water or oxen, one girl turned to Snyder and moaned, "Can't we just shut down?"

"Are you getting nervous?" Snyder smiled.

"I can't *stand* it!" she laughed en route to a run of shutdowns.

Such tensions heighten the imaginative reality of the game, yet the computer marches on without so much as a grin.

Searching for a New World

The essential logic and method of Energy Search are replicated by the companion Search Series programs, yet the tasks at hand are much different. Perhaps the most enjoyable and emotionally charged game in the series is Geography Search. Each team is given a sailing vessel and is told to set sail in search of gold in the New World. After a day's sail, each crew is shown a new configuration of stars from which crew members must plot their latitude. They calculate longitude by measuring the relative angle of the sun with a built-in computer clock, and each new day the computer reports wind direction, water depth, and air temperature.

As in the other programs, this crucial data flashes on the screen for brief intervals, forcing students to collaborate in their note taking. (Single players may choose to regulate the pace of the data displays and waive this high-speed group option.) As is delightfully true in real-world sailing, the boats cannot sail straight into the wind, and with the computer's ever-

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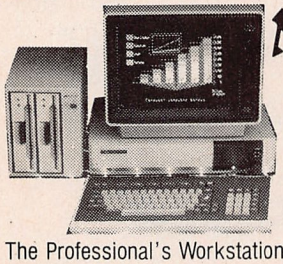

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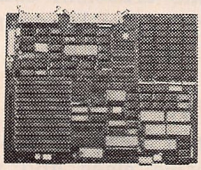

The MPX-16 is Steve Ciarcia's most ambitious project to date. The computer runs all application software written for the IBM PC and is IBM PC bus compatible. Can be used with video monitor & IBM keyboard with optional adapter.

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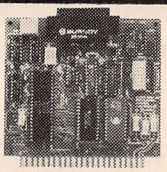

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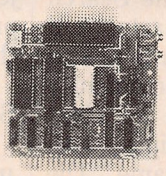

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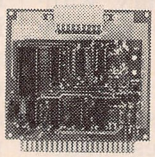

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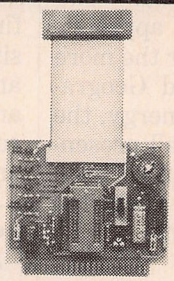

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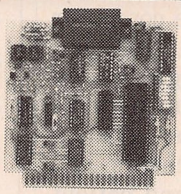

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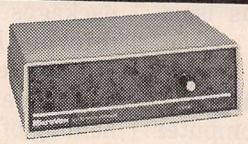

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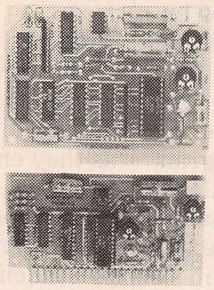

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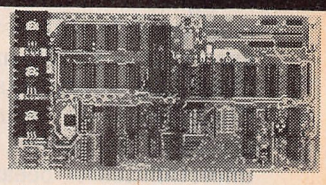

As featured in Ciarcia's Circuit Cellar BYTE Magazine, August 1982

Add color graphics, animation & 3-D effects to your S-100, TRS-80 Model I and III & Apple II at low cost. The Super Editor software package includes a pattern editor, sprite editor, slide show, and demo scenes all in BASIC. Can be used with Color Monitor or TV set and rf modulator.

- Resolution—256 X 192 Pixels.
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Assembled & Tested ..... $249.
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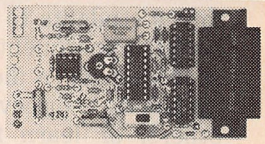

As featured in Ciarcia's Circuit Cellar BYTE Magazine, March 1983

The newest item to Micromint's growing list of products is this 300 Baud Modem. It is crystal controlled, uses the TI TMS 99532 IC, contains just 25 parts and can be used with an acoustic coupler or in a direct connect mode.

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MICRO MINT

changing wind direction, the crew must grapple with detours, setting each course to maximize progress given the constraints of weather. Confronted by storms, pirates, errors in navigation, and the vast uncertainties of ocean sailing, the ships soon lose sight of each other, heading off into dangerous isolation in search of riches.

What the Computer Teaches

In each program, the computer oversees rules, choices, decisions, and data searches that directly relate to each target discipline. The workbooks provided with each program disk contain explanatory chapters that provide facts and principles in the discipline and help students carry out the necessary calculations and strategies.

The documentation stresses that students must discover their own answers. Says one teacher's manual, "The overall guideline regarding student questions . . . is don't answer them!" This strategy forces students to use their workbooks, experiment, look to other sources such as dictionaries or encyclopedias, discover by observing others, or learn from their own trial-and-error experience. This non-teacher-directed philosophy strongly permeates the program materials and Snyder's own thinking, but in more traditional teacher-centered classrooms, extra academic content in the form of special readings, texts, and essay analyses could be added with relative ease.

Teachers will find considerable room for flexibility in working with the series. A Search program is not meant to be used by itself but as a supplement to a particular course of study, much as teachers now embark upon field trips or set up laboratory experiments. Snyder suggests using a Search program for perhaps two class sessions a week while reserving the other three classes to explore the discipline via other activities and methods.

The publisher has done a creditable job in compiling the workbooks that accompany the Search Series. The graphs, charts, and diagrams on which students record data are easy to use and eminently practical. The readings are clear and link academic principles with the evolution of the game. The driving principle behind these packages is that clear, forthright information begets curiosity. Hence we see few obscure tricks and none of the arbitrary withholding of data that makes so many adventure simulations tiresome and often foolishly frustrating.

The greatest weakness of the workbooks is that the presentation of the material is too uniform to be suitable for the broad spectrum of grade levels (5 to 12) the publisher claims can be served by the software. While the vocabulary and sentence structure are appropriately on a higher level for the more complex Archeology and Geography Searches than for Energy, the layout, design, and overall presentation are essentially identical in all the workbooks, making them too juvenile for older students.

Freeing the Teacher

The great strength of the Search Series is that it frees up teachers to interact intimately with students as they engage in an instructive intellectual challenge. The computer is a remarkably good teacher's aide, offering unswerving attention to students. It offers up periodic little true-false quizzes, grading them instantly amid cheers and groans. It is a tireless and patient instructor that the students come to enjoy.

To Snyder the greatest virtue of the simulations is that they get students working together, cooperating, helping, reasoning in groups, and taking responsibility for their own learning.

Teaching students to think, however, is not easily measured on standardized tests. Thus some teachers and administrators will fault the games for not teaching enough facts or for not fitting snugly into previously determined objectives, and this criticism could prevent the series from becoming the smash hit it deserves to be.

Showing the Way

Still, the Search Series is easily used by an entire class and requires only one computer. And because it can store the progress of many teams at a time, it's easy to shuffle from classroom to classroom, teacher to teacher. Unlike individual tutorial software, the series does not require individualizing students' schedules or a special setting or numerous terminals. It is flexible enough to be used easily from fourth or fifth grade through junior high and can be adapted for high school and adult classes.

At very least, the series is a pathfinder. It shows that educational simulations can engage the mind and demonstrates what a smart and savvy teacher can do with a computer to vitalize a classroom and captivate students. □

At a Glance

Name: The Search Series: Energy Search, Geography Search, Geology Search, Archeology Search, Community Search

Type
Classroom educational simulation

Manufacturer
Webster Division, McGraw-Hill Book Co.
1221 Avenue of the Americas, 28th Floor
New York, NY 10020
(800) 223-4180
(212) 997-2646 (for New York State residents)

Price
$180 per program

Format
5¼-inch floppy disk

Computers
Apple II and IIe; TRS-80 Model III with 32K bytes of memory and one disk drive

Documentation
32-page Teacher's Manual in vinyl binder with expendable 32-page student workbooks called Searchbooks

Audience
Students in grades 5 through 9 in groups of 25 to 30

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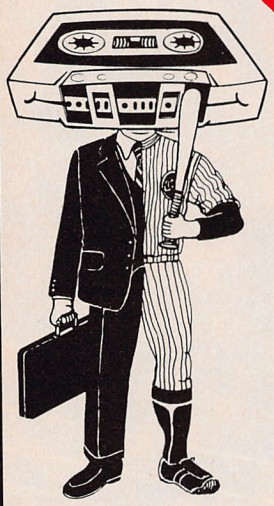

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GAMES

Arcade/Adventure Madness

Six games for the sleuth and star raider in all of us

by Mark Andrews

Jumping from computerized adventure games to arcade-style games can drive you crazy. No movie reviewer in his right mind would sit through back-to-back screenings of *Double Indemnity*, *Star Wars*, *The Seven Percent Solution*, and *Alien*, but a game reviewer can't be so choosy. Still, I steeled myself for this assignment because all six games (three from each genre) show just how far the game programmer's art has evolved in the last year.

Apparently plenty of game players out there enjoy switching hats from Luke Skywalker to Hercule Poirot, because each of these games is selling as well as hotcakes used to. Let's start with the adventure trio.

Pirate Adventure

Scott Adams is arguably the world's most famous designer of adventure games. When he first got interested in game design, computers didn't have high-resolution graphics or 256-color displays. His debut series of 12 text-only adventure games were like old-fashioned radio dramas—fantasies magnified by the mind. You moved through an adventure by typing commands on a keyboard; the computer relayed the results of those moves by posting messages on the monitor. The object of each game was to complete a quest. Although the computer was charitable about offering clues, misunderstanding them was often fatal.

Adams's text adventures were very popular, and he built a successful software company around them. As computer systems got fancier, he began enhancing his programs with color graphics and sound effects. The result was a new batch of games called the SAGA (Scott Adams Graphic Adventure) series.

Even though Pirate Adventure for Apple and Atari computers is considered the simplest SAGA game, it's not what you'd call a snap. It took me two and one-half hours to finish, and I had to start over several times.

Like all SAGA games, Pirate Adventure uses high-resolution graphics to embellish a story rather than represent a field of play. The game's starting point is a room in a London flat, and the object is to find clues in the room that will lead you to treasure buried on a distant island—and to get back to London in one piece. On your sea voyages you'll be chased by a bloodthirsty pirate and insulted by a smart-alecky parrot.

To play the game, you type in two-word commands such as Go Bookcase and Take Book. When you pick up an object, it disappears from the screen and becomes part of the baggage you must carry at all times. You can lug only a limited amount of baggage and must therefore choose it carefully because some items are useless while others are potential lifesavers. When you type I (for Inventory), you'll get both a listing and pictures of the things you're carrying.

Apart from the high-resolution Bluebeard who's stalking you, very little about this game will "shiver your timbers." Pirate Adventure's emphasis is on high jinks and

Mark Andrews is a New York freelancer who has written for *Technology Illustrated* and *Video* magazines.

humor; amusing graphics are its most noteworthy feature. It's a great game for Apple or Atari buccaneers with 48K bytes of RAM (random-access memory) and a bottle of rum.

Mission Impossible

Mission Impossible, perhaps the most demanding game in the SAGA series, is based loosely on the 1960s TV series in which Peter Graves and Martin Landau did the U.S. government's dirty work. The game features saboteurs, closed-circuit TV cameras, a mysterious film cartridge, and (last but by no means least) a nuclear bomb.

Booting the disk on either an Apple or Atari produces graphics showing a tape recorder on a desk. By typing Play Tape, you'll learn that "your mission, should you choose to accept it, is to prevent an automated nuclear reactor from being destroyed by a saboteur's time bomb." (The Apple versions of SAGA games support the Votrax Type 'n' Talk speech synthesizer, in case you'd like to actually hear this grim challenge.)

Because of Mission Impossible's time bomb, the game has a greater urgency than the TV episodes ever did. (You won't have time to kidnap a Bulgarian general, in other words.) Several times during the game you'll see displays of reactor buttons that you must push in precisely the right order if you want to survive. Get the sequence wrong and you'll be blown to smithereens. However, the game has such an entertaining explosion sequence that you'll *want* to get killed at least once, just to see the screen go bonkers.

Mission Impossible's graphics (except for the fabulous detonation) aren't as whimsical as those in Pirate Adventure. Preventing a possible meltdown is certainly more challenging than searching for pirate booty, however, and you'll find that you won't easily tire of your mission.

Ali Baba and the 40 Thieves

Ali Baba and the 40 Thieves gets my vote as the most ambitious game ever written for Atari computers. Its field of play is simply gorgeous: a magic carpet of colors across which our hero, a princess, two-score thieves, and assorted monsters roam.

The object of the game is to rescue said princess from the thieves. You move your characters either by keyboard commands or by joystick (the game supports up to four joysticks simultaneously). The joystick gives you an extraordinary amount of freedom—don't leave Baghdad without it. Without touching a single key, players can pick up weapons, gold, or money; change levels of difficulty; summon new enemies; buy goods in the marketplace; or simply rest.

The game commences to the tune of Rimski-Korsakov's "Scheherezade" as instructions flash on screen in beautiful, Arabic-style lettering. Along the way you'll meet some Middle Eastern elves, several rather pretentious mystics, and dwarves who set traps.

Ali Baba and the 40 Thieves is nothing short of a masterpiece. For my money, the only game that comes close to matching its sophistication is Chris Crawford's Eastern Front. And Ali Baba is an escapist's delight compared to Russians versus Nazis in the Battle of Stalingrad.

Preppie

Was this game created to rid the earth of those rich kids who wear bow ties and saddle oxfords? Sure

At a Glance

Name: Pirate Adventure (Adventure #2, SAGA series)

Type
Adventure game

Manufacturer
Adventure International
(A division of Scott Adams Inc.)
POB 3435
Longwood, FL 32750
(305) 862-6917 or (800) 327-7172

Price
$39.95

Format
5¼-inch floppy disk

Computer
Atari 800 or Apple II with 48K-byte RAM

Documentation
Instruction booklet

Audience
Adventure-game enthusiasts

Name: Mission Impossible (Adventure #3, SAGA series)

Type
Adventure game

Manufacturer
Adventure International
(A division of Scott Adams Inc.)
POB 3435
Longwood, FL 32750
(305) 862-6917 or (800) 327-7172

Price
$39.95

Format
5¼-inch floppy disk

Computer
Atari 800 or Apple II with 48K-byte RAM

Documentation
Instruction booklet

Audience
Adventure-game enthusiasts

Name: Ali Baba and the 40 Thieves

Type
Fantasy/adventure game

Manufacturer
Quality Software
6660 Reseda Blvd., Suite 105
Reseda, CA 91335
(213) 344-6599

Price
$32.95

Format
5¼-inch floppy disk

Computer
Atari 400 or 800 with 32K-byte RAM

Documentation
24-page instruction booklet

Audience
Atari users with an interest in fantasy/adventure games

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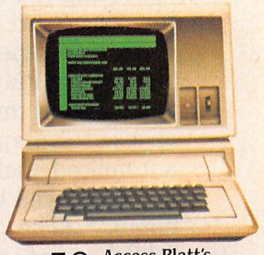
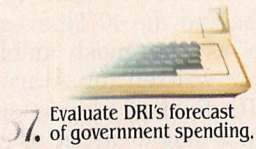
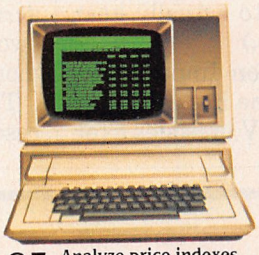


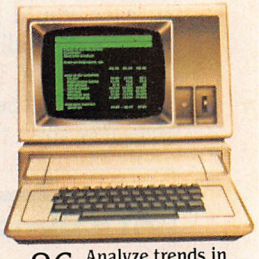
59. Access Platt's Oilgram data.



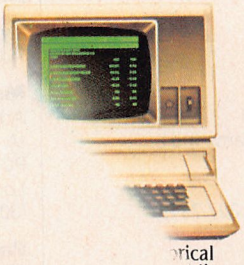
57. Evaluate DRI's forecast of government spending.

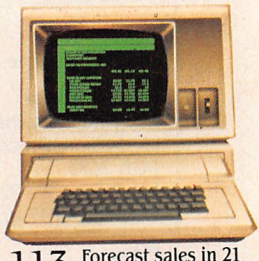


85. Analyze price indexes for key insurance costs.



86. Analyze trends in money markets.





113. Forecast sales in 21 basic industries.

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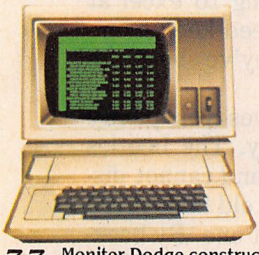
6. Compare your business to U.S. economic trends.

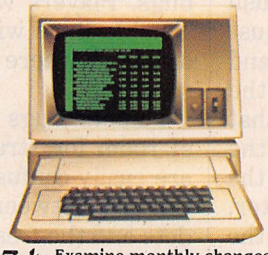
7. Analyze DRI's forecast of inflation, unemployment.

8. Analyze DRI's forecast for housing starts.

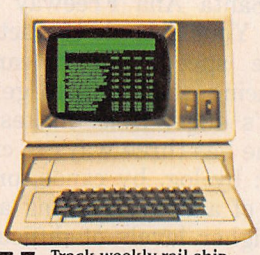
9. Forecast various energy prices.



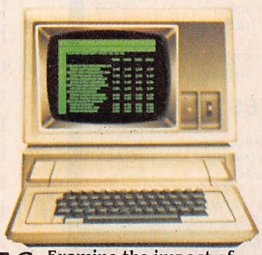
33. Monitor Dodge construction activity by region.



34. Examine monthly changes in paper prices by grades.

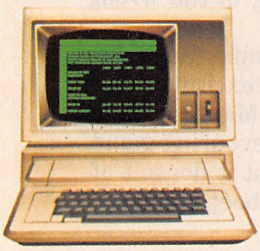


35. Track weekly rail shipments by traffic category.



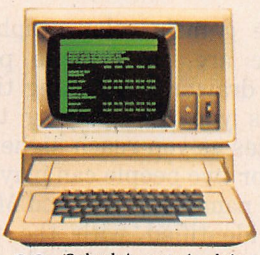
36. Examine the impact of inflation on your business.

37. Evalu of you



60. Compare the cost of living in 25 U.S. cities.

61. Monitor activity for 8 agricultural commodities.



62. Calculate year-to-date portfolio activity.

63. Compare yields of various money market instruments.

64. Calcul marke

87. Evaluate arbitrage across foreign currencies.

88. Compare performance of over 5000 companies.

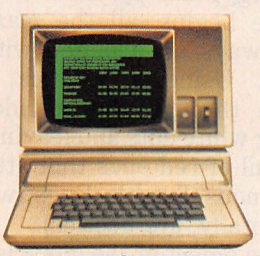
89. Compare performance of 180 industry aggregates.

90. Monitor changes in disposable income in Brazil.

91. Condu analys

114. Analyze inflation rates in Mexico.

115. Measure daily portfolio performance.



116. Access Standard & Poor's Compustat® data.

117. Compare your business to industry trends.

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looks that way, because the Preppie is an endangered species in this fast-action, playing-in-traffic game.

The object of this Atari game is to help a nerdy Preppie cross a fairway and an adjacent river to pick up stray golf balls. The golf course, naturally, is about as tranquil as the Santa Ana Freeway at rush hour. Your Preppie character must evade speeding golf carts and menacing bulldozers to get to the river's edge. If he makes it that far, he has three ways to cross the river: by log, by canoe, or on the back of a Preppie-eating alligator. At higher levels of difficulty, the alligator becomes a malevolent frog.

The game's color graphics and music are, in Preppie parlance, "top drawer." A ticking timer reminds you that playing time decreases as you reach higher levels. One or two people can play (even if their names are Biff and Muffy). If you identified with the preppie-loathing upstart played by Rodney Dangerfield in the movie *Caddyshack*, this game's for you.

Tumble Bugs

Tumble Bugs, for Apples and Ataris, is a maze chase of the Pac-Man variety, but several features set it apart from other dot-devouring games. It takes place inside a labyrinth of twisting corridors in an Egyptian pyramid. When the game begins, all the maze's passageways are clogged with white dots. Using a joystick, players glide through the corridors gobbling white dots and leaving behind a trail of red ones that attract the ravenous Tumble Bugs (which, incidentally, are beetles).

The object of the game is to clear the screen of white dots before falling prey to the voracious Tumble Bugs. Each time you successfully clear the screen, the program advances you to a trickier maze and a new nest of eight Tumble Bugs.

The most innovative thing about Tumble Bugs is its "magic magnifier box," which follows your cursor and magnifies a small patch of the screen. Because the normal display is so reduced, you'll need this electronic magnifying glass in order to move more gracefully than Mr. Magoo. Unfortunately, the area outside the magnifier box is as detailed as a road map; hence you can't even see the approaching bugs. Players wishing to excel at Tumble Bugs will need keen memories of where they've been on screen.

Tumble Bugs leaves you plenty of room for strategy. The beetles are easily confused and cannot distinguish between an old trail of red dots and the freshest one. By backtracking skillfully, you can often send them chomping in the wrong direction.

In summary, Tumble Bugs has terrific graphics and exciting sound effects. Next to Pac-Man itself, this is my favorite dot-devouring game. My only gripe is that it doesn't offer any toe-tapping beetle music.

Astro Chase

Fernando Herrera is quickly building a reputation as The Great Gretsky of game programming. One of his latest creations, Astro Chase, for the Atari, proves that the accolades are justified. From the moment you boot this game, you know it's a winner: a spaceman appears on screen, salutes you, and then is beamed aboard a spaceship and blasts off—all to the tune of Tchaikovsky's "1812 Overture," a theme that continues throughout the game.

Astro Chase is an outer-space action game that creates galaxies of ever-increasing complexity. The galaxies extend beyond the borders of your screen, so scrolling is an essential part of the game. (Because Astro Chase is written in machine language, the scrolling is very smooth.)

The object of Astro Chase, like most cosmic classics, is to save planet earth. While fending off enemy warships, you must zap the advancing Megamines that threaten earth. You can refuel at several energy depots should one of the

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game's "hot stars" drain your ship's fuel supply. Another interesting Herrera-ism is the energy shield, which renders your vessel invulnerable to attack but guzzles precious fuel. The game's essential strategy, then, boils down to fuel consumption versus safety.

Astro Chase is the first computer game to offer what its author calls single-thrust propulsion. That's fancy lingo meaning the ability to move in one direction while firing in another. This type of maneuvering—which involves the coordination of joystick and trigger button—really separates the Sulus from the Kirks. Once you master the technique, you'll wonder how you ever got along without it.

If you examine Astro Chase feature by feature, it doesn't seem all that spectacular. Its imaginative sound and graphics are matched by dozens of other games. But something inexplicably infectious about Herrera's progam makes you want to play it for hours. And that's what separates programmers like Herrera and Scott Adams from the rest of the pack. They understand compulsive behavior better than most shrinks. □

At a Glance

Name: Preppie

Type
Action game

Manufacturer
Adventure International
(A division of Scott Adams Inc.)
POB 3435
Longwood, FL 32750
(305) 862-6917 or (800) 327-7172

Price
$29.95

Format
Cassette tape or 5¼-inch floppy disk

Computer
Atari 400 or 800 with 16K-byte tape or 32K-byte disk

Documentation
Instruction booklet

Audience
Atari users interested in arcade-style action games

Name: Tumble Bugs

Type
Action/strategy game

Manufacturer
Datasoft Inc.
9421 Winnetka Ave.
Chatsworth, CA 91311
(213) 701-5161

Price
$29.95

Format
5¼-inch floppy disk

Computer
Atari 400 or 800 with 24K-byte RAM; Apple II with 48K-byte RAM

Documentation
Instruction booklet

Audience
Adventure-game fans

Name: Astro Chase

Type
Action/strategy game

Manufacturer
First Star Software Inc.
22 East 41st St.
New York, NY 10017
(800) 223-1545

Price
$29.95

Format
5¼-inch disk or cassette tape

Computer
Atari 400 or 800 with 32K-byte RAM

Documentation
Instruction booklet

Audience
Atari users interested in arcade-style games

HOME/BUSINESS

Lightning on a Disk

Datafax and Instant Recall are simple, speedy database programs

by Robert Moskowitz

Let's call them the Light Heavyweights—those database-management programs that aren't quite as powerful as the real heavyweights like dBASE II and Condor. Because of the product glut in this category, buyers are tempted to hold out for that chimerical piece of software that has everything—fast sorts and searches, no limit on record size, flexible report formatting, perhaps even math and logic capabilities.

But I can save you a lot of time and grief: there's no single program that can cover all the bases. For example, some of the Light Heavyweights simply cannot conduct sorts within sorts. Others don't allow for customized reports. And a surprising number of these programs are difficult to update and correct.

The sensible thing to do, therefore, is to purchase several programs to handle your personal database-management needs. Moskowitz's Law states that "several 'very good' programs are more useful than an imaginary 'perfect' one." With that in mind, let's take a look at two Light Heavyweights that complement each other nicely.

Switching to Instant

Instant Recall, a program from Howard W. Sams and Company, is the most easily mastered data storage and retrieval program I've ever used. You can learn how to

Robert Moskowitz is a business consultant based in Canoga Park, California.

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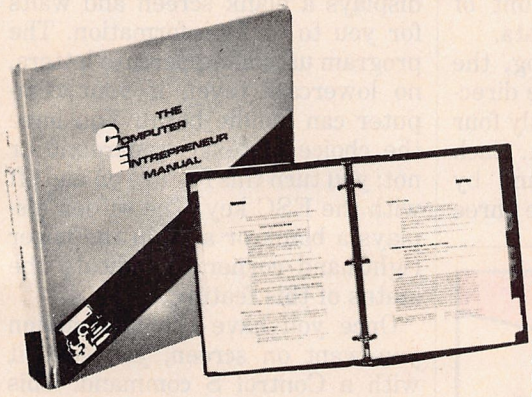

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use it in five minutes, but its simplicity stems from its limitations: Instant Recall really does only five things, but it does them extraordinarily well. The user can enter data, save it, update it, search for it, and print it one screen at a time—that's all. The program offers no search-and-print sequence that instructs the computer to print selected information automatically. Moreover, you can't print anything *less* than a full screen, and you have to reenter the Print command each time.

Beyond its pure simplicity, however, Instant Recall has two big advantages that make it very useful for certain applications. The program is lightning fast. It uses an enhanced disk operating system (DOS), so it loads or saves a file (up to 28,672 characters) in about five seconds and searches a file almost instantaneously. Even better, it automatically searches every word in your file, not just keywords or words in certain fields. This full-text search is rare in microcomputers. It's a terrific boon if you want to enter information without worrying about how you later intend to retrieve it.

Instant Recall boots with a nifty high-resolution logo that makes you feel the package has been prepared by experts. Nothing in its performance will change your mind.

You get Instant Recall working by pressing an appropriate key in the Command mode. Although the screen shows only S and E, you actually have 15 single-key commands to chose from. Numbers at the right display the amount of memory still available for data.

If you enter C for catalog, the program shows you a unique directory listing. You can have only four separate files on a data disk. Each file is listed by number and by name. In addition, you have three lines available for writing memos to yourself about file contents.

You can also enter G to get a file from the disk or P to put a file on the disk. The program has utility commands to rename, lock, unlock, kill, and append disk files. One neat feature is that Append restores a file you have previously deleted, provided you have not written over it with new data. You can also duplicate or initialize data disks. Because Instant Recall does not use the standard Apple DOS, the program can write a file only to a disk that you have initialized under its control.

If you enter E, Instant Recall displays a blank screen and waits for you to enter information. The program uses all uppercase letters, no lowercase (even if your computer can handle both). You have the choice of text wraparound or not; you turn this feature on and off with the ESC key. The screen displays a blank or a W in the lower right-hand corner to indicate the status of this feature.

Once you have the information you want on screen, you save it with a Control S command. This appends the screenful of information (the equivalent of a record in most database programs) to the end of the current working file and assigns the addition the next higher record number. Another storage option is Control R (replace). This command puts the information in the middle of the file instead of at the end. You can replace any stored screen by specifying its number. If you don't give a number, Instant Recall replaces the information you last retrieved. If you were updating a name and address, for example, you would use Control R to replace the old data with the new.

But the best feature of Instant Recall is its full-text search. From the Command screen, enter S to trigger the search sequence. Now you can search for any word or character string (or for screens containing any two words or character strings but no more than two

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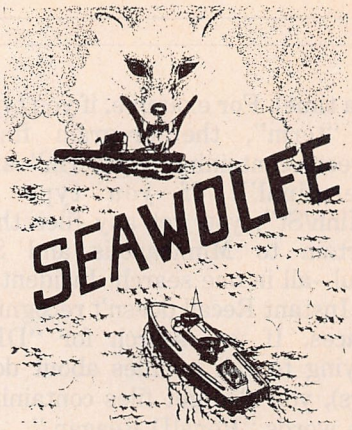

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at a time). For example, if you type in "term", the program finds screens containing "midterm" and "terminal". If you type in "Minn/St", you get any files that pertain to Minneapolis and St. Paul—all in one search. Incidentally, Instant Recall doesn't recognize spaces. If you search for "DR" (trying to call up files about doctors), you also get files containing the words "RonalD Reagan."

Instant Recall searches are lightning fast, taking much less than one second in most tests and *never* more than two seconds. Because of its speed, you needn't plan ahead to make good use of Instant Recall. Type in anything you care to store, disregarding field names or order. Later you can search for any words or strings that seem important—not just keywords.

Although its speed and simplicity are impressive features, Instant Recall has plenty of limitations. There are many tasks it simply cannot do for you. The biggest deficiency is its lack of reporting and formatting capabilities. What you see on the screen is literally what you get on the paper, 40 columns maximum. If you want to get reports on your database—lists, totals, indexes—you've reached for the wrong program.

Another drawback is that Instant Recall uses a unique data-file format that isolates your data from other software and hardware. You cannot, for example, feed data from other programs into Instant Recall, nor can you extract data from it to pass along to another data-management system. Clearly, Instant Recall is not the best program for every application. But it offers terrific possibilities for your simpler reference requirements.

Datafax Packs a Lot

Another effective, easy-to-learn database program is Datafax. This one requires a 64K-byte Apple system with a printer connected through slot 1. Unlike Instant Recall, Datafax accepts an optional 80-column card and lets you upgrade your data files to a hard-disk system at any time.

Although Datafax is a lot more sophisticated than Instant Recall, it's just as easy to use. Instead of relying on a full-text search, Datafax lets you establish as many as 100 keywords for each "folder" (the equivalent of a record in most database programs). Typing in Control-I before you enter a word in the folder marks the word as a keyword. All your searches must be for keywords and combinations of keywords.

Datafax's configuration options let you restructure a number of the program's features, from its edit keys to its printer setup. For example, Datafax works with either a

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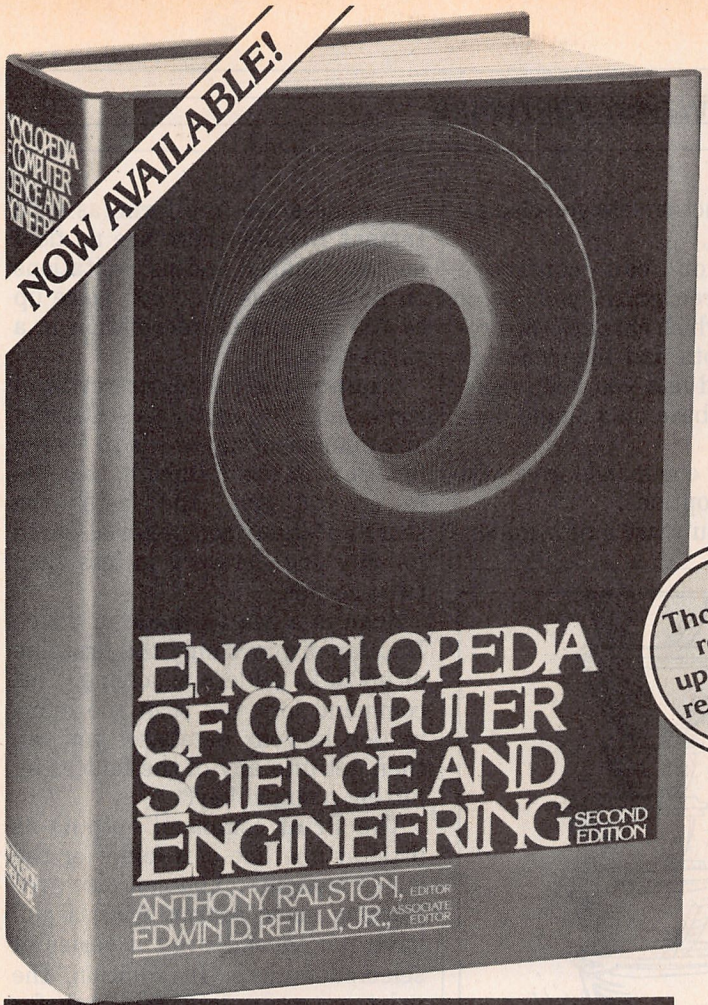

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40-column or an 80-column display. There's only one thing you must specify: whether or not Datafax sends a line feed to slot 1 when it sends a carriage return.

You can also redefine all the command keystrokes for the Datafax text editor. You can choose single-key or two-key commands. (For example, commands can be prefixed by *, #, or +.) Any time you feel uncomfortable with the keyboard setup, this function lets you change things around.

Finally, you can configure Datafax to recognize you as a Pascal user, which changes the program's prompts and file-name expectations and lets you keep more than one database on a single data disk.

Briefly, the commands give you the following options:

New lets you start a new folder. The folders are free form (as with Instant Recall)—there are no field names required and no limitations on field lengths. You can place up to 255 screens of information in a single folder.

Exam is the full-folder retrieval command. To use it, give Datafax any number of keywords to search for. Bear in mind, though, that the fewer you give, the faster the search. Datafax completes a search for any one keyword in less than two seconds.

Scan is a search mode in which Datafax displays only the first line of up to 21 folders at a time. This command lets you scan the information in your database; you can then get into any of the folders by hitting a single key.

The **Print** command outputs as little as one line of a folder or the whole contents. You can also give Datafax some search criteria and have it find and print a series of selected folders. In addition, the print program lets you transfer data into a disk file, the first step in sending it over telephone lines to another computer.

The **Autokey** function lets you specify a list of words that Datafax will automatically mark as keywords every time you enter one in any folder. You can add or delete words on this Autokey list at any time.

The **File** command gives you the status of your current database file: the number of data blocks allocated for the file and currently filled with data, the number of folders in the file, and the number of keywords recorded for the file.

Datafax's command processor is extremely powerful, enabling you to conduct all kinds of multiple sorts and searches. However, the program slows down as your searches get more complex and as the number of keywords increases. That's why you're better off with 50 short keywords per folder than 25 long ones.

Now let's examine some applications to see how the two programs perform head to head.

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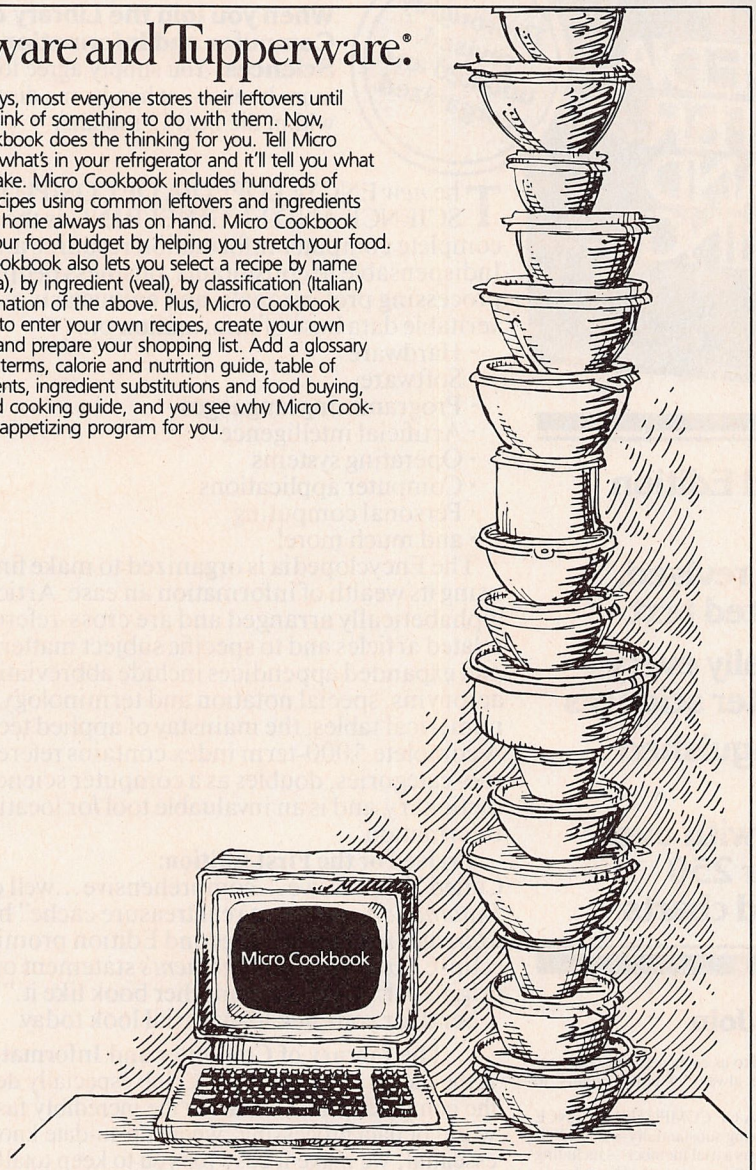

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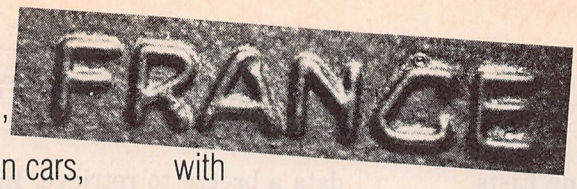

with industry, keeping them in the classroom. Right now, 10 percent of all full-time engineering faculty positions are unfilled, creating overcrowded classes. And threatening the quality of education.

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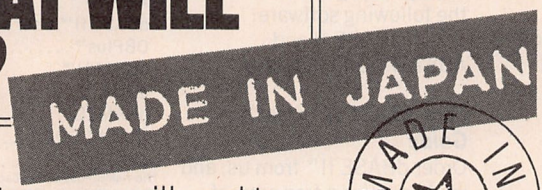

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Address and Phone Lists

This type of data is simple contact information: name, street, city, state, zip code, area code, phone number. Most of the time, you will want to search such a list by last name. You want the list to be fast and easy to use and you don't need any special or advanced features.

Instant Recall will do this job to perfection. Its speed makes the data a breeze to retrieve. In addition, the program allows for retrieval by any part of a name, city, state, or area code.

Datafax also handles this task with ease. However, you will have to enter a lot of extra keystrokes to indicate keywords. If you don't, you won't be able to search for keywords later on. Either program is able to print out the list for you.

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Indexes and Bibliographies

A computerized database is great for scholars and librarians because it's the logical successor to the card file. I favor Instant Recall for this application because it searches every word in your database. This means you can quickly find John Quincy Adams by entering "Quincy" rather than searching every Adams. Datafax works fine for this application too, but it requires more thought and advance planning. The most important thing is to plan your keywords carefully. It's also advisable to maintain a master list of keywords used to date.

Memos to Yourself

I know a university professor who stores everything from wild notions to curriculum reminders in a computerized database file. He sometimes calls up these notes months later as he plans a new course.

Instant Recall is limited here because the prof would be able to store only 28,672 characters in a file. However, the program's full-text search would allow him to search those cranial crannies very quickly.

Datafax is a little better for this type of application because it offers plenty of room for extensive ideas: one half-baked thought can fill an entire data disk if need be. If you have a lot of data and a limited number of keywords, Datafax is probably the better choice. But to handle shorter collections of less organized notes and musings, Instant Recall has the edge.

If you've ever shelled out money for database progams that are really just electronic Rolodexes, you'll be pleasantly surprised by both Instant Recall and Datafax. The former's strong suits are speed and price. The latter is also fast, but it's flexible and designed for a wider range of business applications than Instant Recall. Both programs are a snap to learn, but neither has much to offer when it comes to analyzing the content of your data-

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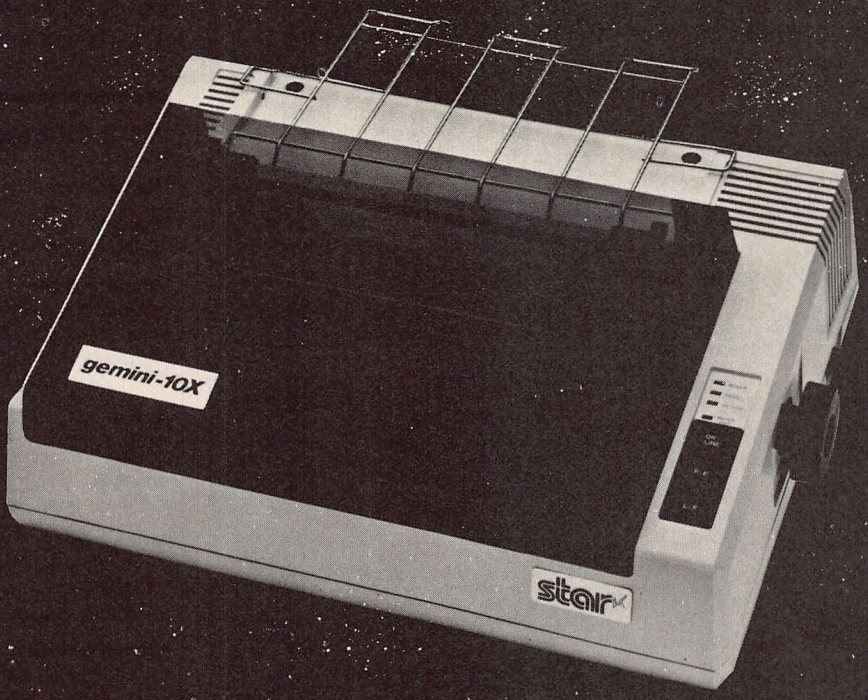

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bases. If your emphasis is on the search—not the scrutiny—of database files, these programs have a lot to recommend them. □

At a Glance

Name: Instant Recall

Type
Data storage and retrieval program

Manufacturer
Howard W. Sams & Co. Inc.
4300 West 62nd St.
Indianapolis, IN 46268
(317) 298-5400

Price
$59.95

Format
5¼-inch floppy disk

Computer
Apple II, II Plus, or IIe with 48K-byte random-access memory (RAM), 1 or more disk drives, optional printer

Documentation
61-page loose-leaf manual

Audience
Apple users who want an extremely fast database program with full-text search

---

Name: Datafax

Type
Data storage and retrieval program

Manufacturer
Link Systems
1640 19th St.
Santa Monica, CA 90404
(213) 453-1851

Price
$199 for Apple II with 40-column display
$249 for Apple II with 80-column display or Apple III
$299 for IBM Personal Computer or Corvus Concept

Format
5¼-inch floppy disk

Computer
Apple II, II Plus, or IIe with 64K-byte RAM, 2 or more disk drives, optional 80-column card in slot 3, optional printer with interface in slot 1; IBM Personal Computer; Corvus Concept

Documentation
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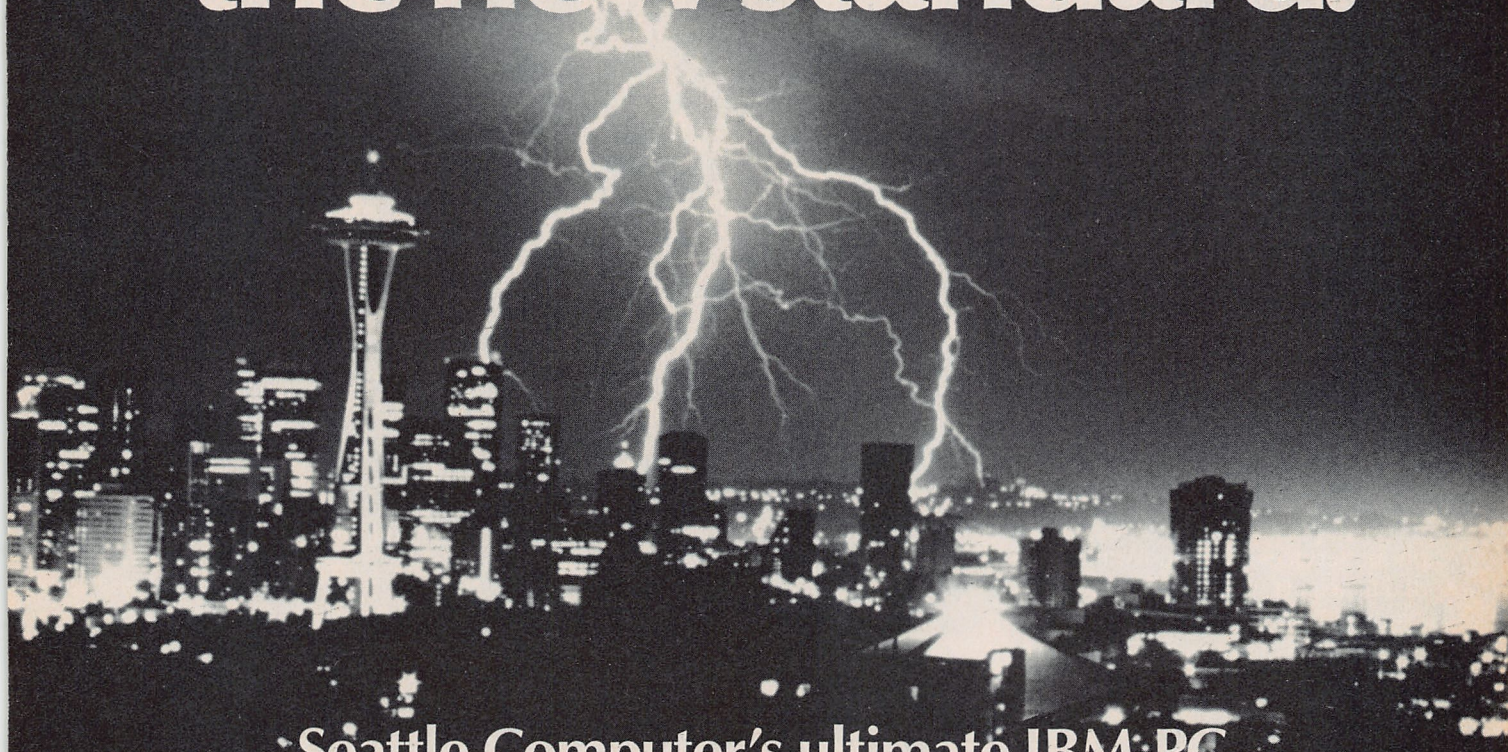

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Dial tone detect on long distance

With special long distance telephone services, you must wait for dial tone part way through a long dialing sequence. The Hayes modem relies on a pause—which works if things go just right. Smart-Cat waits, *detects the tone,* then completes dialing. It *always* works.

True, automatic "redialing"

The Hayes modem gives you a simple *Repeat* of the last command. Enter another command since you last dialed and you've lost the number.

Smart-Cats give you both *Redial* and *Retry.* Redial calls the last number dialed no matter what has happened in between.

Retry keeps retrying on a busy signal. A handy time-saver.

Easy on-line commands

With Hayes, you need escape and re-entry codes when on-line. With the Cats, just enter a single command —or even string a bunch together. Smart-Cats follow them, then go back on-line. No lost contacts. No lost data.

Test everything

The Hayes modem has only internal self-testing. But the Cats do more. They also test the rest of the communications loop. At 1200 baud, the Cats can automatically run data over the line, through the other modem and back. You know if your modem is right. You know if the rest of the loop is right, too.

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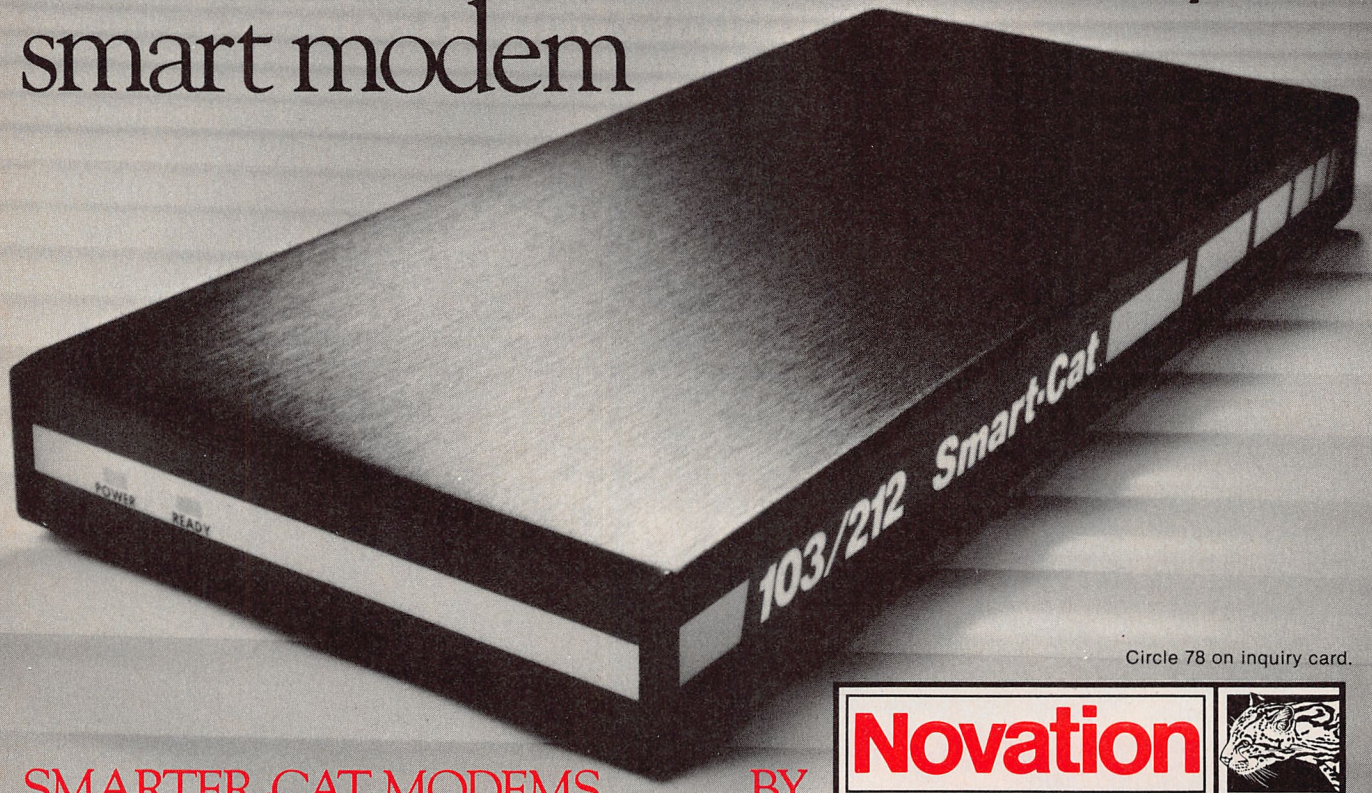

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The Collatz Conjecture

Exploring the mysteries of a classic number puzzle

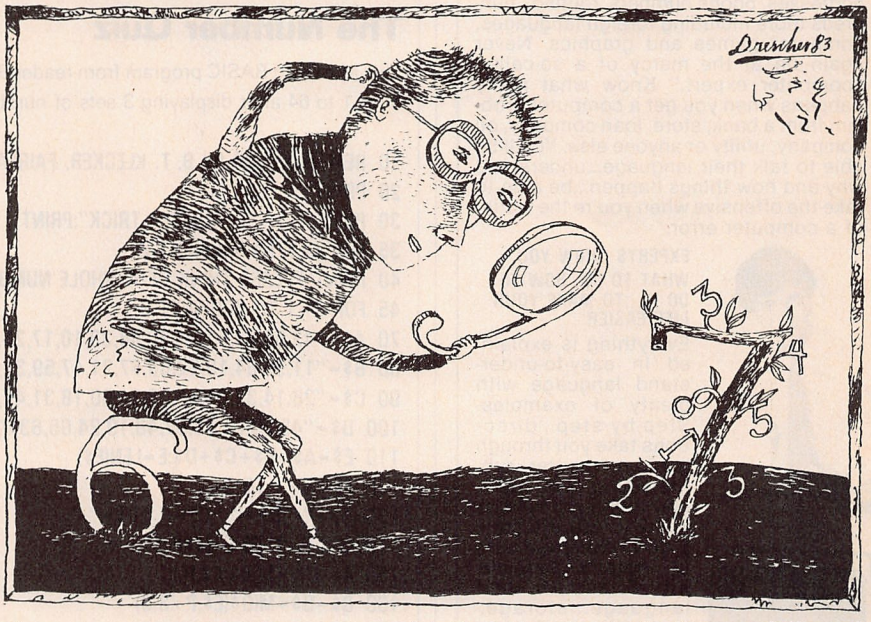


Illustration by Henrik Drescher

Approximately 30 years ago, a professor named Collatz created the following thought provoker, which so far has eluded an explanation by both mathematicians and computer users alike. Here's how it goes:

Start by choosing any whole number. If the number is odd, triple it and add 1. If the number is even, take half. Then take the result and repeat the procedure over and over, at least until you obtain 1. Let's try it with 17. Because 17 is odd, we triple it and add 1 to get 52, also an even number. Half of 52 is 26, an even number. Half of that is 13. Continuing the process, we get the numbers 40, 20, 10, 5, 16, 8, 4, 2, and finally 1.

The Collatz conjecture states that this procedure will always terminate at 1. But this conclusion is not really obvious. After all, when you hit an odd number, you triple the number (which more than compensates for taking halves) and add 1, so how do you know that your sequence doesn't keep growing in spurts? On the other hand, you do have at least one halving for every tripling and adding 1 (because tripling an odd number and adding 1 always yields an even number); you might even have many halvings for each tripling, which could show that the numbers decrease and eventually reach 1. Note that if you hit our old friends the powers of 2 (2, 4, 8, 16, 32, and so on), you will get 1 in short order because you keep dividing by 2 in successive steps.

When trying to figure out how the Collatz conjecture works, you might want to look for patterns in the number of steps it takes for a given number to reach 1. You might also consider making up your own problem. For instance, you could modify the rules as to which numbers to multiply or divide by. Or you could use multiples of 3. I leave it to you to explore some of these points.

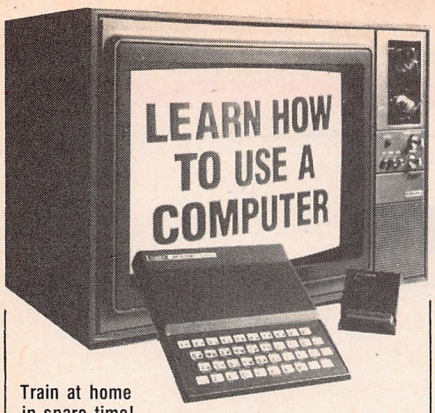
However, don't be overly optimistic about finding a full and complete solution on a microcomputer. Still, amateurs often come up with interesting patterns, observations, and partial solutions missed by professionals. With this caveat and encouragement, then, see if you think Collatz's puzzler is a propitious avenue for computer exploration.

A Novel Solution

Here's an interesting variation on the base-2 trick I showed in this department's maiden appearance last May. The trick was part of a program that let the computer guess a number from 1 to 63 after displaying 6 sets of numbers. Brion T. Klecker of Fairfax, Virginia,

Contributing editor Dr. Michael W. Ecker is a mathematics professor at the Worthington Scranton Campus of Pennsylvania State University.

by Michael W. Ecker



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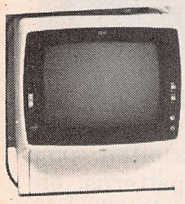

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sent in another program that guesses a number after only half as many displays. Somewhat modified, Brion's Microsoft BASIC program, which he calls The Number Quiz, appears in the listing below. I'll just add that the program makes for a very nice demonstration. Readers are invited to think about how the trick works. Frankly, except for a strong resemblance to a card trick I've seen and used myself, this program is otherwise quite novel, particularly for a microcomputer.

Mind-Reading Trick Explained

Okay, okay, so the mind-reading trick I presented last month was just a matter of playing with one of the properties of 9, but it was a nice trick, wasn't it? I will, as always, explain the mathematical principle involved, but first let me remind you of the trick.

In the original trick, the computer appears to guess your secret number. What you do first is take any whole number and then rearrange the digits to get a new number. For example, suppose you

The Number Quiz

This Microsoft BASIC program from reader Brion Klecker lets your computer guess numbers from 1 to 64 after displaying 3 sets of numbers.

```
10 REM PROGRAM BY B. T. KLECKER, FAIRFAX, VA
20 PRINT
30 PRINT"          NUMBER TRICK":PRINT
35 FOR Z=1 TO 800:NEXT Z
40 PRINT"PLEASE THINK OF A WHOLE NUMBER FROM 1 TO 64"
45 FOR Z=1 TO 500:NEXT Z
70 A$="42,55,23,51,44,30,54,33,10,17,25,39,06,13,62,27,"
80 B$="11,58,64,16,22,08,57,21,47,59,36,46,40,15,03,41,"
90 C$="26,14,38,01,53,37,34,60,18,31,49,28,12,50,35,09,"
100 D$="45,20,61,56,07,48,19,24,05,63,02,43,29,04,52,32,"
110 E$=A$+B$+C$+D$:E=LEN(E$)
120 FOR T=1 TO 3
130 A$=" ":B$=" ":C$=" ":D$=" "
140 FOR P=1 TO E STEP 12
150 A$=A$+MID$(E$,P,3)
160 B$=B$+MID$(E$,P+3,3)
170 C$=C$+MID$(E$,P+6,3)
180 D$=D$+MID$(E$,P+9,3)
190 NEXT P:PRINT
200 PRINT A$:PRINT B$:PRINT C$:PRINT D$:PRINT:PRINT
210 INPUT "IS THE NUMBER IN ROW 1, 2, 3, OR 4";L
220 ON L GOTO 230,240,250,260:GOTO 210
230 E$=B$+A$+D$+C$:GOTO 270
240 E$=C$+B$+A$+D$:GOTO 270
250 E$=D$+C$+B$+A$:GOTO 270
260 E$=A$+D$+C$+B$
270 PRINT:NEXT T
280 PRINT "OK, I AM READING YOUR MIND . . . ":PRINT:PRINT
290 FOR Z=1 TO 800:NEXT Z
300 PRINT "YOUR NUMBER IS ";MID$(E$,E/3,2)
310 FOR Z=1 TO 500:NEXT Z
320 INPUT"PLAY AGAIN (Y OR N)";X$
330 IF X$="Y" THEN 20
340 END
```

take 80458. One rearrangement might be 40885. Next, you subtract the smaller of the two numbers from the larger. In this case, you get 80458 – 40885 = 39573. Now pick a digit from the difference, 39573 (never pick a 0 if it appears in the difference). If you type in the remaining digits in the difference, the computer actually determines the missing digit. I also offered a variation of the trick in which the second number, rather than having the order of the digits scrambled, is simply the sum of the digits of the first number.

The principle involved here is essentially the same in both cases. It is based on a property of 9 which states that the remainder obtained when any number is divided by 9 is the same as the remainder obtained when the sum of the digits of the number is divided by 9. For example, consider the number 1234. When you divide 1234 by 9, you get a remainder of 1. Try it and see. Now consider the sum of the digits of the number 1234 (1+2+3+4 = 10). When you divide 10 by 9, you also get a remainder of 1.

That example explains the basic principle, but we need another example to explain the trick. Again, start by taking any number, say, 91234. Next, add up the digits to get a second number, in this case 19. The basic principle tells us that these two numbers have the same remainder when divided by 9, in this case 1.

Now go a step further and take the difference between the two numbers (91234 – 19 = 91215). Notice that the difference has no remainder when divided by 9. It turns out that this result always occurs no matter what number you first choose, because the remainders cancel each other out during subtraction.

The rest of our "proof" should be more obvious. Because the difference (91215) is a number that leaves no remainder when divided by 9, we know that the sum of the remainder's digits (18) also leaves no remainder, according to the basic principle I cited earlier.

In other words, the sum of the digits of the difference is always a multiple of 9. So if you throw away any digit in the difference (which the program asks you to do), the missing digit (your secret number) must simply be whatever is needed to make the sum of the digits a multiple of 9. Incidentally, you were not allowed to pick a 0 as your secret number because the program would not be able to distinguish it from a 9.

A Quick Answer

In the August issue, I asked for the smallest number with the property that when its leftmost digit is moved to the far right, the resulting number is exactly 3 times as large as the original number. Did you find the answer? It is the number 142857. You can readily check that 3 times 142857 does equal 428571, the number obtained when the digit 1 is moved from the far left to the far right. No smaller number has this property. Alert readers will recognize 142857 as the number involved in the magic trick presented in the August issue and explained in last month's issue. Also, 142857 is the repetend, the repeating part or block, in the decimal equivalent of 1/7: 1/7 = .142857142857 . . . .

Next month we'll present another recreational puzzle for you. Until then, remember that your results, variations, and questions may be published several months down the line, so keep sending your comments to me and enclose a self-addressed, stamped envelope if you want a reply:

Dr. Michael W. Ecker
Contributing Editor
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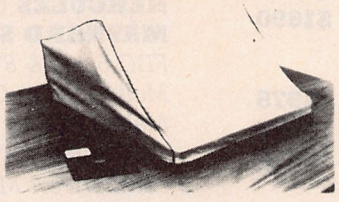

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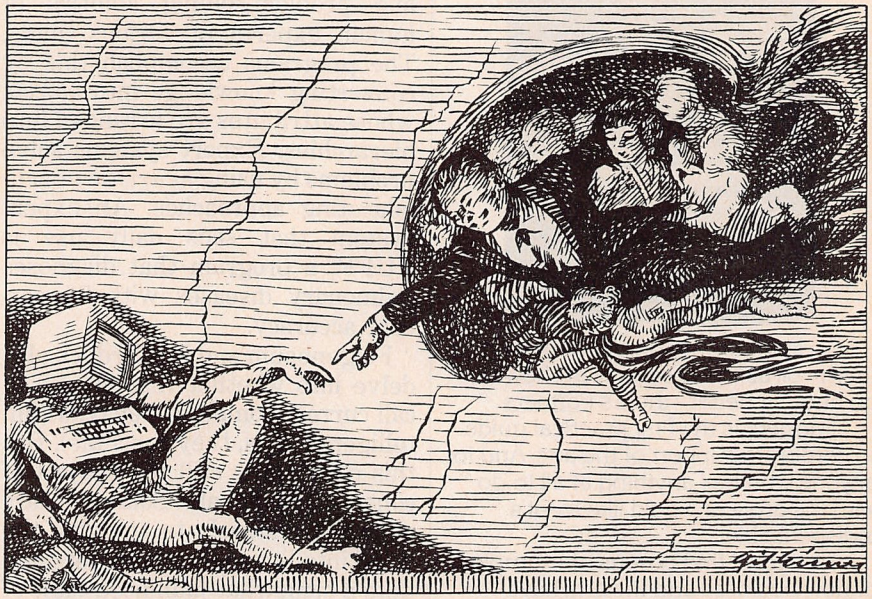
The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World

Edward Feigenbaum and Pamela McCorduck
Addison-Wesley Publishing Co.
Reading, MA, 1983
275 pages, hardcover $14.95
Reviewed by John O. Green



America seems to have passed the baton in world auto and steel supremacy, and we've let our immense expertise in space exploration lie largely fallow. Are we also going to cede to the Japanese and others our top ranking as innovators and manufacturers of high-technology systems? This is the question Edward Feigenbaum and Pamela McCorduck ask in *The Fifth Generation.*

The book is a "good read" made up of bite-sized sections of three or four pages that provide an interesting analysis of what ails America at the dawn of a new age, a task for which the authors are eminently qualified.

Science writer McCorduck has been an observer of the artificial intelligence scene for years, leading to her book *Machines Who Think* (W. H. Freeman, 1979). Feigenbaum, described by a colleague as the "czar of expert systems," has served as chairman of the Computer Science Department at Stanford University and is the founder of Teknowledge and Intelligenetics, two pioneering knowledge-engineering firms in Palo Alto. As Feigenbaum and McCorduck candidly proclaim at the beginning of the book, they are "decidedly not disinterested observers."

With their continual, impassioned plea for action, the authors have created the kind of book that fosters congressional hearings and presidential commissions. Feigenbaum and McCorduck would like it to do much more. They reiterate a theme we've heard so often over the past few years:

> *The wealth of nations, which depended upon land, labor, and capital during its agricultural and industrial phases—depended upon natural resources, the accumulation of money, and even upon weaponry—will come in the future to depend upon information, knowledge, and intelligence.*

It's a vision of a reality that promises to upend society as we know it and deliver us kicking and screaming into a new and (we hope) better world. Never mind that the better world has been the promise (some pessimists would say the carrot) of new technology ever since the industrial revolution—this time it's really going to happen, say the authors, and they're not alone. As the authors see it, the study of arti-

John O. Green is a freelance writer living in Menlo Park, California.

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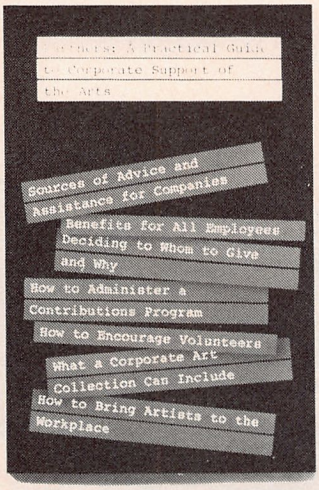

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ficial intelligence, particularly as it is applied to the development of expert systems, will lead the way to the world of tomorrow.

In the first few chapters, Feigenbaum and McCorduck review and explain the arcane field of artificial intelligence (AI). They define it as the domain in which researchers strive to give computers capabilities we would call intelligence in humans.

Currently the hottest projects in AI, expert systems (also known as knowledge-engineering systems) attempt to model the knowledge and problem-solving abilities of human experts in various fields. The programs accomplish this by converting knowledge into *objects* whose attributes are arranged into hierarchies. Expert systems solve problems by using *heuristic* or self-educating approaches. An expert system that sees daily use is PUFF, a program that diagnoses pulmonary diseases with 80 percent accuracy.

Feigenbaum and McCorduck also delve into whether it is proper to call current computer behavior "intelligent" (it is, they conclude). But this question is still the subject of considerable debate. Some scholars object strenuously to applying the word intelligence to computers and take a somewhat jaundiced view of the whole field of artificial intelligence research. Hubert Dreyfus, a philosopher at the University of California at Berkeley, argues that no computer derived from our present technology (including the so-called fifth generation) can ever be intelligent in the sense of human intelligence. He claims that human behavior, understanding, and language are not reducible to a set of rules or knowledge structures that can be fed to a computer. His colleague, Professor John Searle, argues that even if computers could be programmed to do everything humans do, they still would not have understanding and intelligence.

Calling this controversy an "arid little debate," Feigenbaum and McCorduck give short shrift to what is actually one of the more fascinating questions in any age: what is the nature of humankind and how do we think? The authors avoid this debate (probably wisely) and get on with the central purpose of their book.

Visiting the Institute of New Generation Computer Technology (ICOT) in Tokyo, Feigenbaum and McCorduck were deeply impressed by the speed with which Japanese AI researchers are closing the gap between them and American researchers. With eight of Japan's biggest electronics firms committing some of their finest young engineers to the project and all the major government labs similarly involved, the authors claim the Japanese effort is moving twice as fast as ours. Japan's powerful Ministry of International Trade and Industry (MITI) is currently footing the bill ($450 million over the next ten years) for the incredibly ambitious project.

ICOT's goals are a source of controversy in Japan as well as in the United States. Among other projects, the Japanese are working on a machine to translate between Japanese and English with a vocabulary of 100,000 words as well as a speech-recognition system able to understand continuous human speech with a vocabulary of 50,000 words and 95 percent accuracy with a few hundred or more speakers (most current systems can handle a few hundred words at best). This capability could be used in immensely marketable applications such as a speech-to-text typewriter. ICOT also hopes to make great leaps in picture and image processing and robotics.

Can the Japanese pull this off? The authors put it this way:

> *To accomplish these goals, the Japanese must not only improve present computing capabilities dramatically but also make major innovations in existing technology that will allow very fast associative retrievals, perform logical inference operations as fast as current computers perform arithmetic, utilize parallelism in*

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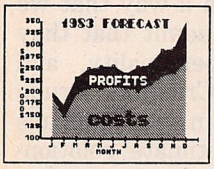

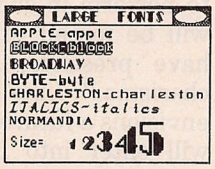

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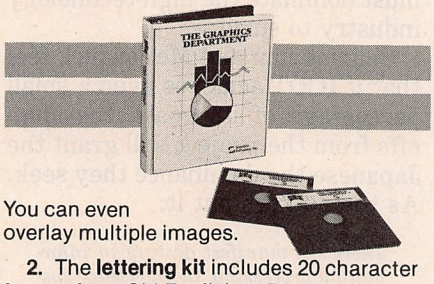

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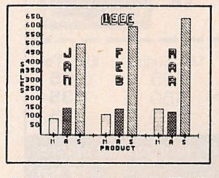

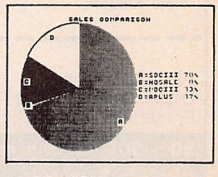

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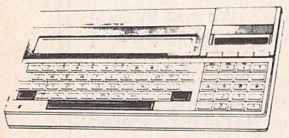

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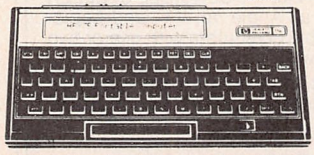

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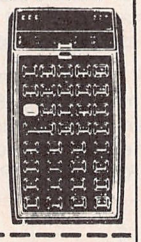

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Some skeptics see the Japanese venture as nothing more than an immense PR event. How, they ask, can the Japanese solve the problems that have baffled American AI researchers for the past twenty years? Many Western observers are inclined to think that the vaunted Fifth Generation project will fizzle out after some early successes when it runs up against the same brick walls that researchers in this country have encountered.

Don't scoff too soon, say Feigenbaum and McCorduck. The Japanese have much more than yen invested in the project. For one thing, they see it as a means of transcending their image and role as the premier technological copycats of the twentieth century. More important, they perceive their very survival as a prosperous nation as tied directly to achieving some of the goals of the project. As a nation poor in energy and natural resources, Japan believes that it must dominate the high-technology industry to survive.

Feigenbaum and McCorduck feel that if ICOT achieves even a small percentage of its goals, the spin-offs from the project will grant the Japanese the dominance they seek. As the authors put it:

There's a manifest destiny in information processing, in knowledge systems, a continent we shall all spread out upon sooner or later. The difference is that the Japanese already have the wagons loaded and are rumbling off down the trail.

The intense single-mindedness of the book occasionally gives one an uneasy feeling that the authors' version of utopia would be a world where everyone was busily working on supercomputers and expert systems. But their urgency is also frequently convincing.

As a nation we seem to have tremendous difficulty in reaching agreement on what needs doing and equal difficulty getting our rugged individualists together to do it. But once we finally embark on a high-stakes cooperative venture, success typically follows. The big effort for the big prize is really what Americans do best (witness, of course, the Apollo program), and we seem to feel better as a nation when we're doing it.

If we aren't vigorously going to explore the possibilities of space right now, perhaps we should embark on a fifth generation project of our own. We have little or nothing to lose and everything to gain. But as Feigenbaum and McCorduck hammer home, we may have much to lose if we don't.

The Intimate Machine

Neil Frude
New American Library
New York, 1983
256 pages, softcover $14.95
Reviewed by Larry Tritten

Neil Frude's *The Intimate Machine* is a more structured, intellectual analysis of some of the themes explored with pop casualness in Michael Crichton's 1973 movie *Westworld*: the social ascendancy of robots, the limits of artificial intelligence, and how high-technology is changing the way we tend to anthropomorphize lifeless objects.

Early on, Frude predicts that "computers and robots will be built to perform in such a way that we will be forced to admit that they have presence, personality, and charisma." Like Crichton, Frude envisions a future in which humans will enter into intimate relationships with machines. Companion machines, he suggests, might play a variety of social roles in our lives, ranging from the electronic cat to lifelike humanoid lovers.

Because this is essentially the book of a high-tech apologist, it dwells on the positive with only cursory attention to the negative. The belief that humanity could so easily be charmed by a race of synthetic beings as to casually forgo

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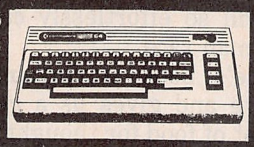

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its customary biological vanity and egotism is a little hard to swallow. In a world where people of different hues (let alone views) have trouble accepting one another, it's extremely idealistic to suppose that a host of electronic automatons will so effortlessly captivate the human race.

Frude's book is certainly provocative and gives us a generous banquet of food for thought, but its philosophical meat needs a bit of basting with a sauce of skepticism. Toward the end he carries rampant extrapolation over the brink with a view of the future that becomes hyperlyrical in its science-fiction excesses. Among other things, he foresees robot pastors and judges, synthetic models of dead relatives, and Shakespearean automatons in Elizabethan garb programmed with the Bard's complete works. The speculation is lively but a bit unrestrained compared to the tone of the rest of the book. For example, Frude's claim that sex with an artificial being might well become preferable to the real thing doesn't recognize the fact that sex is more than just a mechanistic or consumer experience; it's also a result of courting or pursuit, and its rewards are for the ego as well as the glands. Moreover, Frude fails to note that these ersatz lovers, preachers, and pets are likely to be costly. If large stuffed animals are beyond the means of most of today's parents, one wonders just how affordable an electronic cat (not to mention an electronic lover) will be in the near future. It is in such matters that Frude's speculation is weakest, being a sort of utopian skin-diving in which every oyster is rife with pearls.

Yet just when one has accommodated the author's cheery vision of the future, Frude comes up with a dour and cautionary postscript. If humans allow themselves to become subservient to machines, Frude fears, the machines may eventually find us too boring to keep around—even as pets.

Frude's subliminal message becomes masochistic when he imagines machines capable of meting out punishment to the living. (Perhaps he was unduly influenced by those scenes of the Yul Brynner robot trying to blast and maim the flesh-and-blood Richard Benjamin in *Westworld*.) Yet the *real* masochism posed by tomorrow's computers and robots is the cost of purchasing and maintaining them. Using today's portable computers as a yardstick, it's going to be a cold day in Hades before the common man can afford these electronic cuddlies.

So come on, Neil. Your speculations are intriguing, but before I start coveting my intimate machine, I want some assurance that I can afford one. Do they accept Mastercard at Westworld?

Global Stakes: The Future of High Technology in America

by James Botkin, Dan Dimancescu, and Ray Stata (with John McClellan)
Ballinger Publishing Co.
Cambridge, MA, 1982
248 pages, hardcover $17.50
Reviewed by Beverly Cronin

High technology is the one vital segment of a domestic economy that's just starting to work its way out of a long recession. A healthy future, however, is far from assured. Trouble in education, unfavorable domestic economic policies, and tough international competition all pose very real threats to the success enjoyed by America's high-tech industries.

In *Global Stakes*, James Botkin, Dan Dimancescu, and Ray Stata consider "the facts and figures, arguments and opinions, that affect the future of high technology in America." Although offering no comprehensive solutions, the authors make us aware of the precarious lead U.S. high-tech industries hold internationally and suggest where we as a nation should put our priorities and concentrate our efforts to ensure that this country doesn't take a backseat as high

technology races forward throughout the world.

Reasons for concern, as the authors illustrate, are various and plenty. Probably the most shocking is the condition of our educational system. In the way of a serious indictment, the authors write, "Stormy in the 1960s, subdued in the 1970s, American education is now in disarray."

The picture they paint looks grim indeed. Many students graduate from high school with no more than a rudimentary knowledge of science and math. Consequently, colleges must expend scarce resources—money and class time—on remedial programs before students can progress to more advanced studies. Reaganomics, cutting into educational funding, is limiting the number of new programs and depleting scholarship funds. Because technology is changing so rapidly, lab equipment (such as computers and scientific instruments) becomes dated more quickly than it can be replaced. There is not enough room at the universities for all the students who would like to be there, and many schools want to keep a lid on the number of students admitted to their computer science and electrical engineering programs, fearing that educational standards will fall without a proportional increase in faculty and equipment. High salaries in industry lure professors away from teaching and discourage young graduates from entering that profession. Military and defense priorities are siphoning engineers away from private enterprise. If all this weren't enough to cope with, encroaching market competition from abroad exacerbates the situation.

The problems with the educational system didn't crop up overnight, of course. The authors believe that "they indicate a decade or more of failure by policymakers to construct a cohesive and coherent long-term education and training strategy." They call for increased commitment on the part of educators and political leaders to upgrade the quality of education before it's too late; in their view the federal government should lead the way: "Education must become a matter of national priority, one to which the federal government would devote its resources."

To that end, Sen. Paul E. Tsongas (D-Mass.) has introduced a bill (S.631) that he calls the High Technology Morrill Act, which would form a partnership between state governments, private industry, and educational institutions to work toward the common goal of strengthening science, engineering, and technical education. The new bill is fashioned after the original Morrill Act signed by Abraham Lincoln in 1862, which, as the authors remind us, "fused the interests of government, education, and the farming community into a national policy." The benefits reaped by the Morrill Act of 1862 are clear today: the U.S. leads the world in agricultural exports. Tsongas and his allies hope that a similar act for high tech would yield the same results.

But the educational network is not the only weak point, the authors caution. America's economic base is shifting away from the traditional capital-intensive industries to the rapidly emerging knowledge-intensive industries. The "sunset" industries such as steel, paper, and automobiles require heavy investments in machinery. The "sunrise" industries such as communications, computers, microelectronics, and other information technologies require instead a greater investment in people. One major problem plaguing our economy is a national tax structure that does little to stimulate investment in the sunrise industries that the authors believe hold the hope of the future. "The

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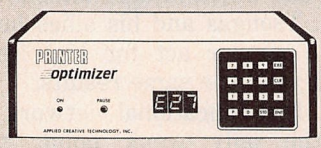

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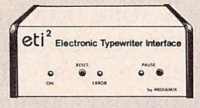

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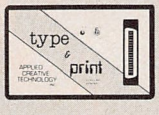

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economic problems of America's old industries are real enough," they warn, "but our chief shortcoming is our persistence in applying old thinking to new situations. Many fail to comprehend that a long-term cycle of old industry is being transformed into or even superseded by a new period of knowledge-intensive economic activity. And many others, while they recognize that a new era has begun, fail to act accordingly."

The authors call for all policymakers, both public and private, to formally address the needs of high technology. As they remind us, "The missing piece in a game of global stakes is a coherent, visionary, and articulate national policy for a knowledge-intensive era." Such a policy would help cement new partnerships among academia, industry, and state governments. These partnerships need federal support to remain viable. Only a concerted national effort can sustain them. After looking at France and Japan, where the governments have recognized the need for decisive national policies and work in various ways with the private sectors to strengthen their economies, the authors pinpoint four challenges federal leaders face in creating a national economic policy strong enough to support a long-term redirection of our national goals to benefit high tech. They are a commitment on the part of the federal government to sustained financial support, a recognition of the need for and concurrent steps to implement life-long education policies, incentives for bettering education, and an acknowledgment of a more global view of technology.

The American scene is not completely bleak, though. Consider, for example, the Wang Institute of Graduate Studies. The authors describe the Tyngsboro, Massachusetts, institute as a "leading-edge experiment. Neither a trade school nor a feeder for Wang Laboratories, the institute attempts to surpass Harvard and MIT in providing master's level education for a high-tech economy." In contrast to the situation at colleges and universities, Wang Institute's teacher salaries are on a par with industry levels, and students use the very latest equipment and enjoy unlimited computer time.

Drawing on diverse yet complementary backgrounds, the authors have pooled their talents to produce a highly readable and informative book. Botkin holds a PhD from the Harvard Business School in computer-based systems, Dimancescu is a high-technology consultant and writer, and Stata is the founder and president of Analog Devices Inc. This wide range of experience has served them well in developing an insightful, comprehensive view of trends in high-tech industries.

In addition to presenting their own theories, the authors have devoted a portion of the book to outside views. In Chapter 10, "The Future of High Technology," the authors furnish a forum to political, corporate, and educational leaders who are actively addressing some of the troublesome areas the authors point out. In that group are James B. Hunt Jr., governor of North Carolina, John A. Young, president of Hewlett-Packard Company, and Dr. Paul E. Gray, president of the Massachusetts Institute of Technology. The short pieces in this section close the book on an optimistic note as the dynamic thinkers the authors have surveyed offer strategies for preserving America's lead in the high-technology race.

Clearly written, shocking in part, *Global Stakes* is a call for America to revitalize and reform its educational system and redirect its thinking to create a favorable environment in which the sunrise industries can flourish. Substantiating theory with ample facts, the authors present cogent arguments and a powerful call for action. We who want to assure America a bright economic future had better pay heed to this book. □

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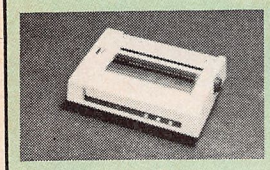

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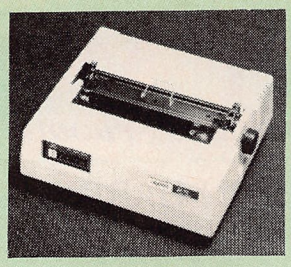

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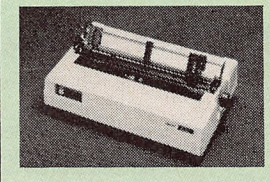

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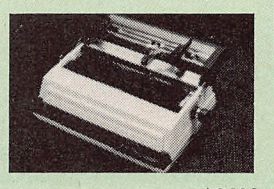

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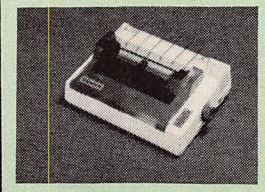

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MONITORS

USI

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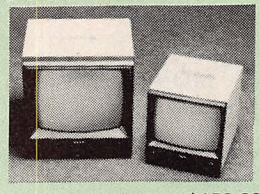

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US ROBOTICS

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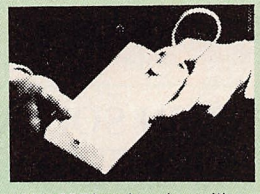

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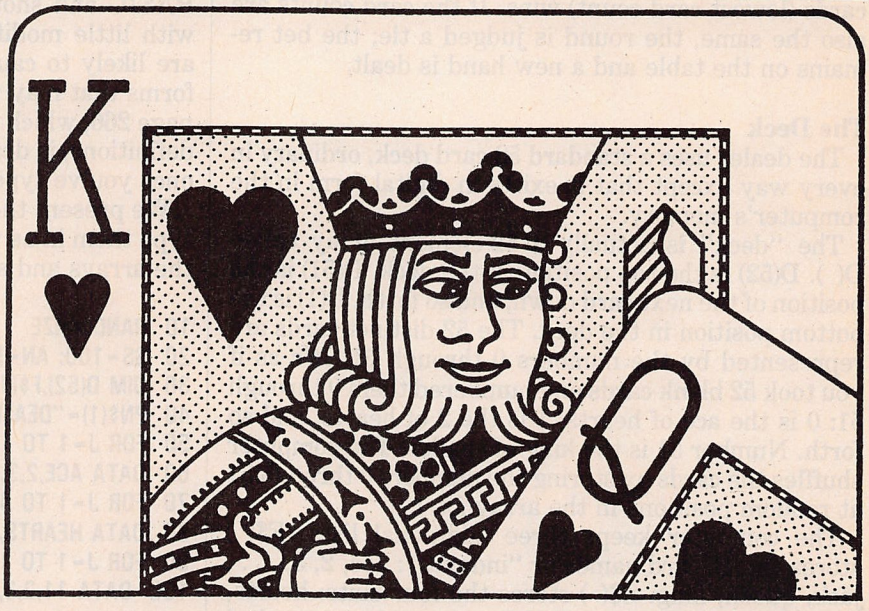
Blackjack '84

Learn to win in the privacy of your own home

by George Stewart



Blackjack, or twenty-one, is one of the most popular card games in casinos in the U.S. The rules are simple and the strategy for winning is not too difficult. In this article, we present a program that turns your computer into a blackjack dealer so you can sharpen your skills without risking a thing—except, perhaps, a little pride.

To keep the program from getting too long, we have abbreviated the rules of blackjack without changing the essentials. This shortened version should be acceptable even to veteran blackjack players because there are dozens of variations of the game anyway. We call our version Blackjack '84 in hopes that it will continue to entertain you during the coming year.

Object and Rules of the Game

In Blackjack '84 you play against the computer, henceforth referred to as the dealer. The object of the game is to acquire a hand that totals 21 or comes as close as possible to 21 without going over or "busting." The hand with the highest total not exceeding 21 wins. The values of each card are

Aces—11 or 1 at your option
Jacks, queens, kings—10
Others—same as the card's index: 2, 3, 4, and so forth.

Note that a card's suit (hearts, diamonds, clubs, or spades) has no effect on its value.

You place bets using imaginary chips. At the beginning of a game, you have 100 chips. To start each hand, you must put five chips, called the ante, on the table; this amount serves as the winner's pool. As play progresses, you may increase the size of the pool.

The dealer and player both receive two cards to start. Only one of the dealer's cards is visible to you, however, so you can't tell precisely how good or bad the dealer's hand is. In a real game of blackjack, each player's cards are dealt facedown so the players cannot see each other's hands. In our version, because the dealer doesn't care what cards you have, your cards are dealt faceup.

After receiving your first two cards, you have four options: increase your bet; receive another card ("hit"); keep your present hand ("stand"); or review the current state of the game.

You continue hitting and betting until you bust or are satisfied with your total. If you bust, the round ends immediately and the dealer automatically takes the winnings without having to show his hand or draw

George Stewart is a contributing editor of *Popular Computing*.

Illustrations by Mark Fisher

additional cards. That's one of the advantages of being the dealer.

If you stand, the dealer then takes a turn at improving his hand. However, his procedure for doing so is predetermined. If his total is less than 17, he must draw a card; if the total is 17 or more, he must stand. A lack of flexibility is one of the disadvantages of being the dealer—and the key to your winning opportunities.

After the dealer stands, the two hands are totaled and compared. In our version of the game, if you win with a total of 21 (called a blackjack), you receive triple the amount in the pool. If you win with a total less than 21, you receive double the amount in the pool. If you lose to the dealer or bust (draw a total more than 21), the winnings pool goes to the dealer. If both hands have the same total, the hand containing the fewest cards (lowest card count) wins. If the card counts are also the same, the round is judged a tie; the bet remains on the table and a new hand is dealt.

The Deck

The dealer uses a standard 52-card deck, ordinary in every way except that it exists in digital form in the computer's memory.

The "deck" is actually a 52-element array called D( ). D(52) is the top position in the deck, D(51) is the position of the next card down, and so forth. D(1) is the bottom position in the deck. The 52 distinct cards are represented by the numbers 0 through 51. It's as if you took 52 blank cards and numbered them 0 through 51: 0 is the ace of hearts, 1 is the 2 of hearts, and so forth. Number 51 is the king of spades. The computer shuffles the cards by storing the numbers 0 through 51 at random positions in the array D( ).

The computer keeps three additional lists. F$( ) stores the 13 card names or "indexes": ace, 2, 3, . . . , jack, queen, king. S$( ) stores the four suits: hearts, diamonds, clubs, spades. V( ) stores the numerical value assigned to each of the 13 indexes. These numerical values correspond to the values for ace through king that we listed above. So, for example, V(1) is 11, V(2) is 2, and V(13) is 10.

How does the computer translate the card numbers 0 to 51 into card indexes and suits?

Let's look at indexes first. Card indexes repeat in four periods of 13, corresponding to the four suits. For example, 0, 13, 26, and 39 all correspond to aces; 1, 14, 27, and 40 all correspond to 2s; and so forth.

The modulo function (MOD), used in algebra and number theory, expresses this correspondence nicely. For a given modulus m, x MOD m is the remainder after "short" or integer division of x by m. For example, 30 MOD 13 = 4 because 30 divided by 13 equals 2 with a remainder of 4.

For any card number, we express it in modulo 13, which produces a number from 0 to 12. Now we add 1, getting a number from 1 to 13, which corresponds to the 13 possible index names. To summarize:

Index number = Card number modulo 13 + 1
Index name = F$ (Index number)

To determine a card's suit, we observe that card values 0 to 12 are hearts, 13 to 25 are diamonds, 26 to 38 are clubs, and 39 to 51 are spades. Dividing a card number by 13 and discarding the fractional part of the quotient gives us a number from 0 to 3. Adding 1 gives us a number from 1 to 4, corresponding to the four suits. The formulas to do all this are

Suit number = Integer part of (card number ÷ 13)+ 1
Suit name = S$ (Suit number)

The Program

The program is written in standard Microsoft BASIC and should run on most personal computers with little modification. Where language differences are likely to cause problems, we suggest alternative forms that may work on your computer. The table on page 266, which summarizes all the variable and array definitions, is designed to help you debug the program once you've typed it in.

We present the program in logical blocks so you can type them in as we go along. The first block initializes the arrays and sets up other constant values.

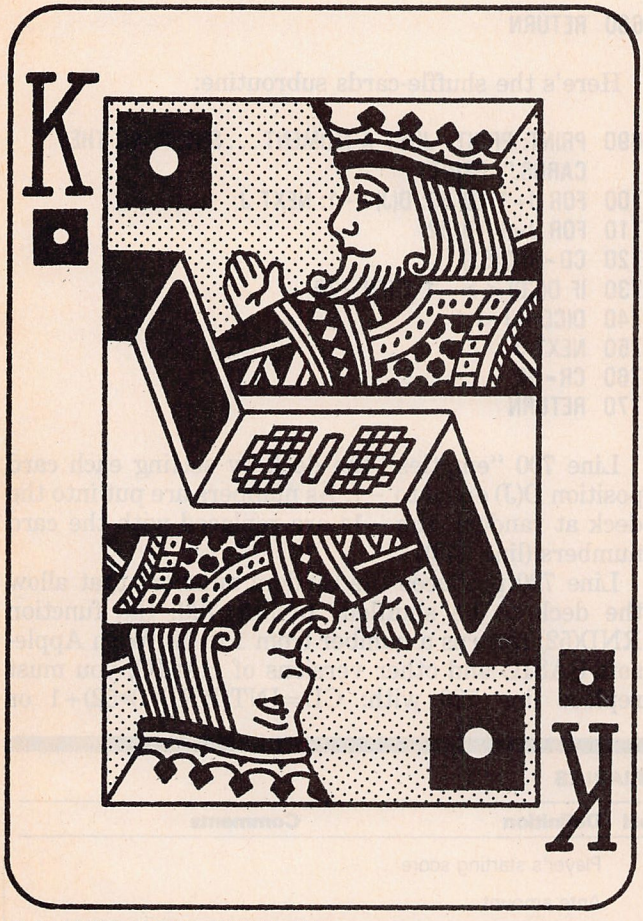
```
10  RANDOMIZE
20  SS=100: AN=5: DS=17
30  DIM D(52),F$(13),S$(4),H(2,11),A(2),V(13),T(2),C(2),PN$(2)
40  PN$(1)="DEALER": PN$(2)="PLAYER"
50  FOR J=1 TO 13: READ F$(J): NEXT J
60  DATA ACE,2,3,4,5,6,7,8,9,10,JACK,QUEEN,KING
70  FOR J=1 TO 4: READ S$(J): NEXT J
80  DATA HEARTS,DIAMONDS,CLUBS,SPADES
90  FOR J=1 TO 13: READ V(J): NEXT J
100  DATA 11,2,3,4,5,6,7,8,9,10,10,10,10
```

Line 10 resets the random-number function (used later in the program) so the program won't shuffle the deck the same way each time you run it. Some versions of BASIC use RANDOM instead of RANDOMIZE. Other BASICs may not need this feature at all but use a built-in clock instead. Consult your computer's BASIC language reference manual for details.

For details on the other variables introduced in this block, see the table.

The next program block starts the game.

```
110  CLS: REM CLEAR THE SCREEN
120  SC=SS
130  PRINT "*** BLACKJACK '84 ***": PRINT
140  PRINT "YOU HAVE" SC "CHIPS TO START WITH."
150  PRINT "THE ANTE IS" AN
160  PRINT "HERE'S THE FIRST ROUND . . ."
170  GOSUB 690
180  IF SC>=AN THEN 190
182  PRINT "YOU CAN'T MAKE THE ANTE."
```



```
184 PRINT "GAME OVER.": END
190 SC=SC-AN: PB=AN
200 PRINT "AFTER PUTTING UP THE ANTE, YOU HAVE"
210 PRINT SC "CHIPS REMAINING."
220 PRINT: PRINT "NEW HAND"
230 SF=0
240 FOR WH=1 TO 2
250 T(WH)=0: C(WH)=0
260 GOSUB 780
270 GOSUB 780
280 GOSUB 830: GOSUB 940
290 NEXT WH
```

Line 110 is the start of the new-player routine. CLS clears the screen. Applesoft BASIC uses the HOME command to do the same thing. Line 170 shuffles the deck. Line 180 is the start of the new hand. The program returns to this point each time a player agrees to play another round. If a player doesn't have enough chips to make the ante, the game ends (lines 182 and 184). Otherwise, the program continues. SF is set to 0 (line 230); this tells the display-hand subroutine to hide the dealer's first card from view. Lines 240 to 290 constitute a loop (a repetitive procedure) that gives the player and the dealer their first two cards and displays the resultant hands. The variable WH indicates whose turn it is: WH=1 for the dealer, WH=2 for the player.

Both the player and dealer have two cards now. The following block gives the player a chance to increase his bet, get another card, stand, or review the totals.

```
300 IF T(2)>21 THEN 480
310 WH=2
320 INPUT "BET, HIT, STAND, OR REVIEW CARDS (B/H/S/R)"; YN$
330 IF YN$="B" THEN GOSUB 630: GOTO 320
340 IF YN$="H" THEN GOSUB 780: J=C(2): GOSUB 1010:
    PRINT "CARD IS" CN$;: GOSUB 1070: GOSUB 830: GOTO 300
350 IF YN$="R" THEN PRINT "YOU HAVE" SC "CHIPS.":
    PRINT "THE BET IS" PB: FOR WH=1 TO 2: GOSUB 830:
    GOSUB 940: NEXT WH: GOTO 310
360 IF YN$="S" THEN 380
370 GOTO 310
```

Line 300 checks the player's total, T(2). If T(2) is greater than 21, the player is busted whether he likes it or not, so the computer doesn't bother giving him any options. Each time the player receives a new card, the program returns to this line, rechecking the total for a bust (see the last statement in line 340).

If the player stands, the program gives the dealer a turn. The following block serves this purpose.

```
380 WH=1: PRINT: PRINT "DEALER'S TURN: ";
390 IF T(1)>=DS THEN PRINT "DEALER STANDS.": GOTO 440
400 PRINT "DEALER TAKES A CARD:"
410 GOSUB 780: J=C(1): GOSUB 1010
420 PRINT "CARD IS" CN$;: GOSUB 1070: GOSUB 830
430 IF T(1)>21 THEN 440 ELSE 390
```

Line 390 determines whether the dealer has reached the magic number 17 (DS), at which he must stand. Line 430 checks to see whether the dealer has busted. The program loops through lines 390 to 430 until one of these two things occurs.

```
440 SF=1: WH=2: GOSUB 830: GOSUB 940
450 PRINT "PLAYER'S SCORE IS" T(2)
460 WH=1: GOSUB 830: GOSUB 940
470 PRINT "DEALER'S SCORE IS" T(1)
480 PRINT: IF T(2)>21 THEN PRINT "PLAYER BUSTS. DEALER
    WINS" PB: GOTO 590
490 IF T(1)=T(2) THEN PRINT "SCORES ARE THE SAME.":
    GOTO 540
500 IF T(2)=21 THEN PRINT "BLACKJACK! PLAYER WINS"
    PB*3: SC=SC+PB*3: GOTO 590
510 IF T(2)>T(1) THEN PRINT "PLAYER WINS" PB*2:
    SC=SC+PB*2: GOTO 590
520 IF T(1)>21 THEN PRINT "DEALER BUSTS. PLAYER WINS"
    PB*2: SC=SC+PB*2: GOTO 590
530 PRINT "DEALER WINS" PB: GOTO 590
540 IF C(2)<C(1) THEN T(1)=0: GOTO 570
550 IF C(1)<C(2) THEN T(2)=0: GOTO 570
560 PRINT "STANDOFF.": GOTO 220
570 PRINT "LOWEST CARD COUNT WINS"
580 GOTO 500
```

```
590 INPUT "PLAY ANOTHER HAND (Y/N)"; YN$
600 IF YN$="Y" THEN 180
610 IF YN$<>"N" THEN 590
620 END
```

Lines 400 to 470 display and total the player's and dealer's hands. In line 440, SF is set to 1 so the display-hand subroutine will show the dealer's first card, which was hidden until now.

Lines 480 to 530 compare the two hands and pick the winning hand. Lines 540 to 580 resolve ties. The hand with the most cards loses a tie; the program takes care of this rule by setting the total T( ) equal to 0 and recomparing the totals (lines 540 and 550 and lines 570 and 580). When the winner has been identified and paid off, the dealer offers to play again in line 590.

That's the end of the main program. The rest of the listing consists of subroutines. Here's the increase-your-bet subroutine:

```
630 PRINT "YOU HAVE" SC "CHIPS REMAINING. HOW MUCH
    DO YOU WANT TO ADD"
640 INPUT B: IF B>SC THEN 630
650 SC=SC-B: PB=PB+B
660 RETURN
```

Here's the shuffle-cards subroutine:

```
690 PRINT: PRINT "JUST A MOMENT . . . SHUFFLING THE
    CARDS.": PRINT
700 FOR J=1 TO 52: D(J)=-1: NEXT J
710 FOR J=1 TO 52
720 CD=RND(52)
730 IF D(CD)<>-1 THEN 720
740 D(CD)=J-1
750 NEXT J
760 CR=52
770 RETURN
```

Line 700 "empties" the deck by setting each card position D(J) equal to −1. As numbers are put into the deck at random, the −1s are replaced with the card numbers (line 740).

Line 720 produces the random numbers that allow the deck to be shuffled. In line 720, the function RND(52) returns a number from 1 to 52. With Applesoft BASIC and other versions of BASIC, you must replace line 720 with: CD=INT(RND(1)*52)+1 or

Summary of Variables

This table contains definitions of variables used in the blackjack program. Use the table as an aid to debugging and modifying the program.

ARRAYS

Label	Definition	Comments
D( )	The shuffled deck	D(52) is the top position; D(1) is the bottom position.
F$( )	The card index names	Ace, 2, 3, . . . , jack, queen, king
S$( )	The card suit names	Hearts, diamonds, clubs, spades
H(,)	The card hands	First subscript determines the player; second subscript determines the order in which the card was dealt. H(1,3) refers to the dealer's third card.
A( )	Number of aces in each hand	A(1) totals the dealer's aces; A(2) totals the player's aces.
V( )	Scoring value of each card	V(1) is value of ace; V(13) is value of king; and so forth.
T( )	Total score of each hand	T(1) is dealer's; T(2) is player's.
C( )	Number of cards in each hand	C(1) is dealer's; C(2) is player's.
PN$( )	Player's name	PN$(1) is "Dealer"; PN$(2) is "Player."

VARIABLES

Label	Definition	Comments
SS	Player's starting score	
AN	Ante amount	
DS	Dealer's hit/stand limit	
J	Miscellaneous counter variable	
SC	Player's current score (chip total)	
PB	Total of player's current bet	
SF	Show/no-show flag	When SF=0, dealer's first card is hidden.
WH	Player selector	WH=1 for dealer, WH=2 for player
YN$	Miscellaneous input variable	
CD	Card selector	Ranges from 1 to 52; see line 720.
CR	Cards remaining	Counts no. of cards remaining in deck. Each time cards are shuffled, CR is set to 52.
CV	Card number	Ranges from 0 to 51
TT	Temporary total score	Used in subroutine to total a player's hand
VL	Index number	Ranges from 1 to 13; V(VL) is the scoring value of a card.
SU	Suit number	Ranges from 1 to 4; S$(SU) is the suit of a card.
CN$	Common card name	For example, ace of diamonds
T	Miscellaneous counter variable	

possibly CD=INT(RND(0)*52)+1 or even CD=INT(RND*52)+1. Check your computer's BASIC language reference manual to be sure. At any rate, the result of line 720 should be a random value from 1 to 52.

Line 760 sets CR, the card counter, to 52, indicating that the deck is full.

The following subroutine draws a card from the deck.

```
780 IF CR=0 THEN GOSUB 690
790 CV=D(CR): CR=CR-1
800 C(WH)=C(WH)+1
810 H(WH,C(WH))=CV
820 RETURN
```

Line 780 checks to see whether any cards remain to be drawn. If CR=0, there are no more cards, so the deck is reshuffled (GOSUB 690).

In line 790, the variable CV gets the number of the card that is drawn; the number ranges from 0 to 51. The card-counter variable CR is reduced by 1.

In line 800, C(WH) keeps track of how many cards are in the dealer's or player's hand, and in line 810, the card number is put into the dealer's or player's hand H(,).

The subroutine to total a player's hand follows:

```
830 TT=0: A(WH)=0
840 FOR J=1 TO C(WH)
850 CV=H(WH,J)
860 VL=CV MOD 13+1
870 IF VL=1 THEN A(WH)=A(WH)+1
880 TT=TT+V(VL)
890 NEXT J
900 PRINT
910 IF TT>21 AND A(WH)>0 THEN TT=TT-10: A(WH)=
    A(WH)-1: GOTO 910
920 T(WH)=TT
930 RETURN
```

Line 830 sets a temporary subtotal to 0 and sets the ace counter to 0. The ace counter is needed because aces can be evaluated as either 11 or 1, whichever value gives the highest score without busting.

Line 860 uses the modulo function discussed previously. If your computer doesn't have MOD, replace line 860 with VL=CV−INT(CV/13)*13+1.

When the program reaches line 900, it has a temporary total. However, if the total indicates a bust, the program might still save the hand by evaluating the aces as 1s instead of 11s. Line 910 takes care of this function. If the hand contains an ace, the program subtracts 10, giving the ace its optional value of 1 instead of the previously assigned value of 11.

The following lines constitute the display-hand subroutine. The variable WH determines whose hand is displayed.

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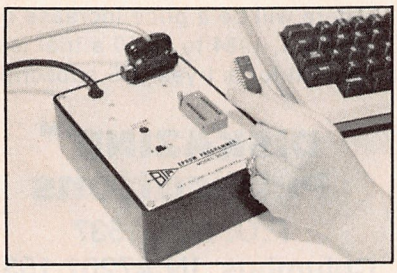

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```
940 PRINT PN$(WH) " 'S HAND:"
950 FOR J=1 TO C(WH)
960 GOSUB 1010
970 PRINT CN$ " / ";
980 NEXT J
990 PRINT
1000 RETURN
1010 CV=H(WH,J)
1020 VL=CV MOD 13+1
1030 SU=INT(CV/13)+1
1040 IF WH=1 AND J=1 AND SF=0 THEN CN$="?? OF
     ?????": GOTO 1060
1050 CN$=F$(VL)+" OF "+S$(SU)
1060 RETURN
```

Line 1020 uses the modulo function again; if your computer doesn't have it, substitute VL=CV−INT(CV/13)*13+1. When the dealer's hand is being shown, the variable SF in line 1040 determines whether his first card is shown. CN$ in line 1050 is a string composed of the card's index and its suit, joined by the word "OF". The final subroutine in line 1070 provides a delay to make the program a little easier to follow as it progresses.

```
1070 FOR T=1 TO 500: NEXT T: RETURN
```

Testing the Program

After typing in the program and removing all obvious typographical errors, test the card-shuffling subroutine by adding these lines:

```
101 GOSUB 690: REM . . . SHUFFLE THE CARDS
102 FOR J=1 TO 52
103 PRINT D(J);
108 NEXT J
109 STOP
```

Run the program. It should print out the numbers 0 to 51 in random sequence. If it does, you know the cards have been shuffled properly.

Now add these lines and run the program again:

```
103 CV=D(J)
104 WH=2
105 GOSUB 1020
106 PRINT CN$
```

This time the computer should print out the name of every card in the deck in random sequence.

Once these subroutines are working, delete lines 101 through 109, and play the game. If you notice any errors in the scoring or playing sequences, check the appropriate section of your program listing, using the table and our commentary as a guide. □

Do you have questions about this article or suggestions for future projects? Send them to The Program Factory, POB 397, Hancock, NH 03449. Enclose a self-addressed, stamped envelope if you want a reply.

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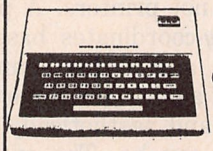

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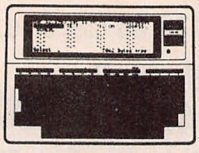

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New Grabbers from Atari

Atari has announced four new computers to replace its 400, 800, and 1200XL. These range from the 600XL (16K-byte memory for $199 list) to the 1450XLD, a 64K-byte computer with built-in disk drive and modem. Next month, West Coast Editor Michael J. Miller provides extensive reviews of the new Atari computers. Just when home-computing waters seemed quiet, these new arrivals promise to shake them up like Jackie Gleason on water skis.

Word Processors for the Commodore 64

Ever since the release of the Commodore 64, people have been muttering, "Ah, the price is great, but will there be enough good software?" Next month we take a look at four word-processing programs for the Commodore 64 that may change that computer's trying-to-catch-up image.

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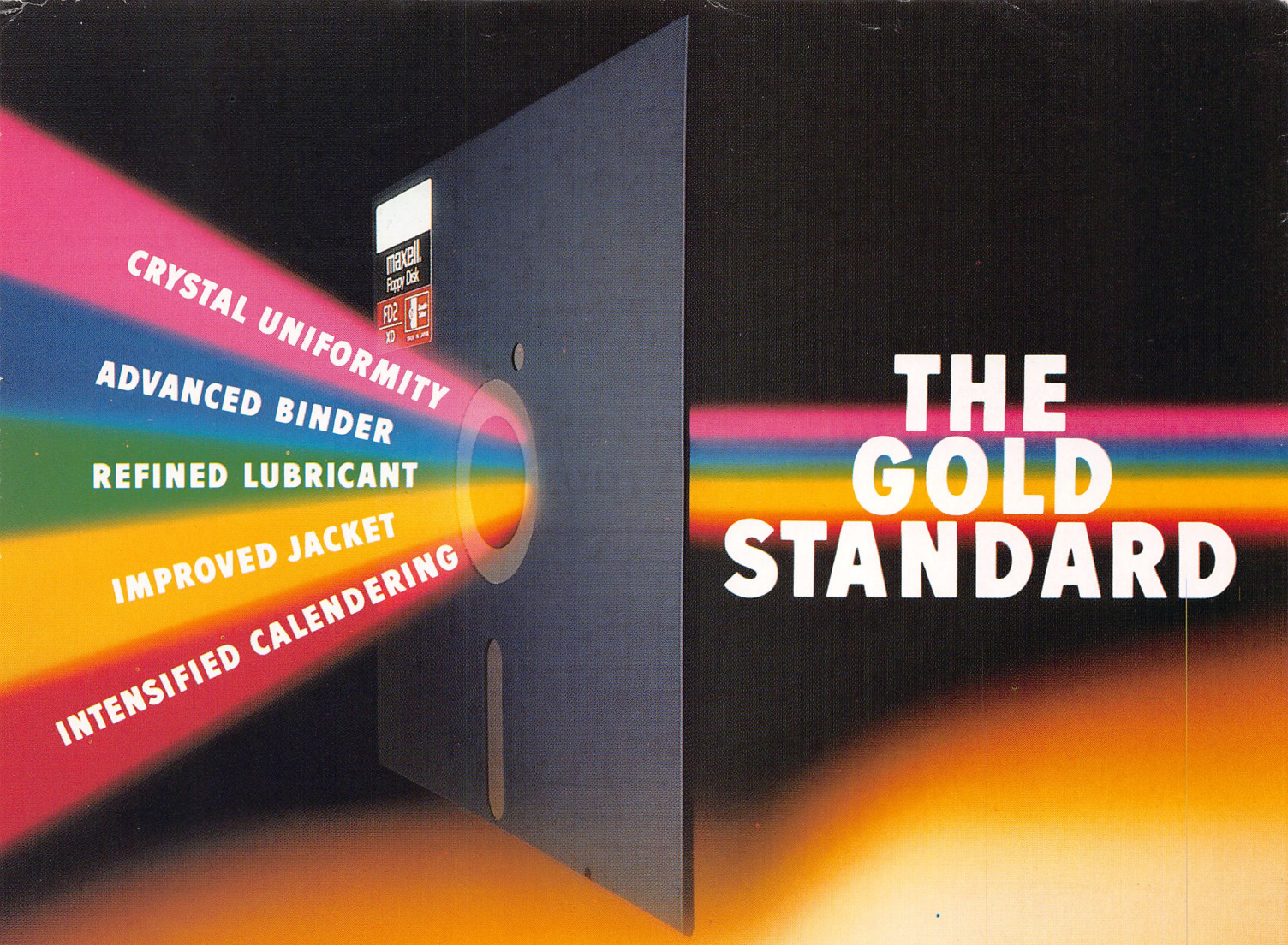

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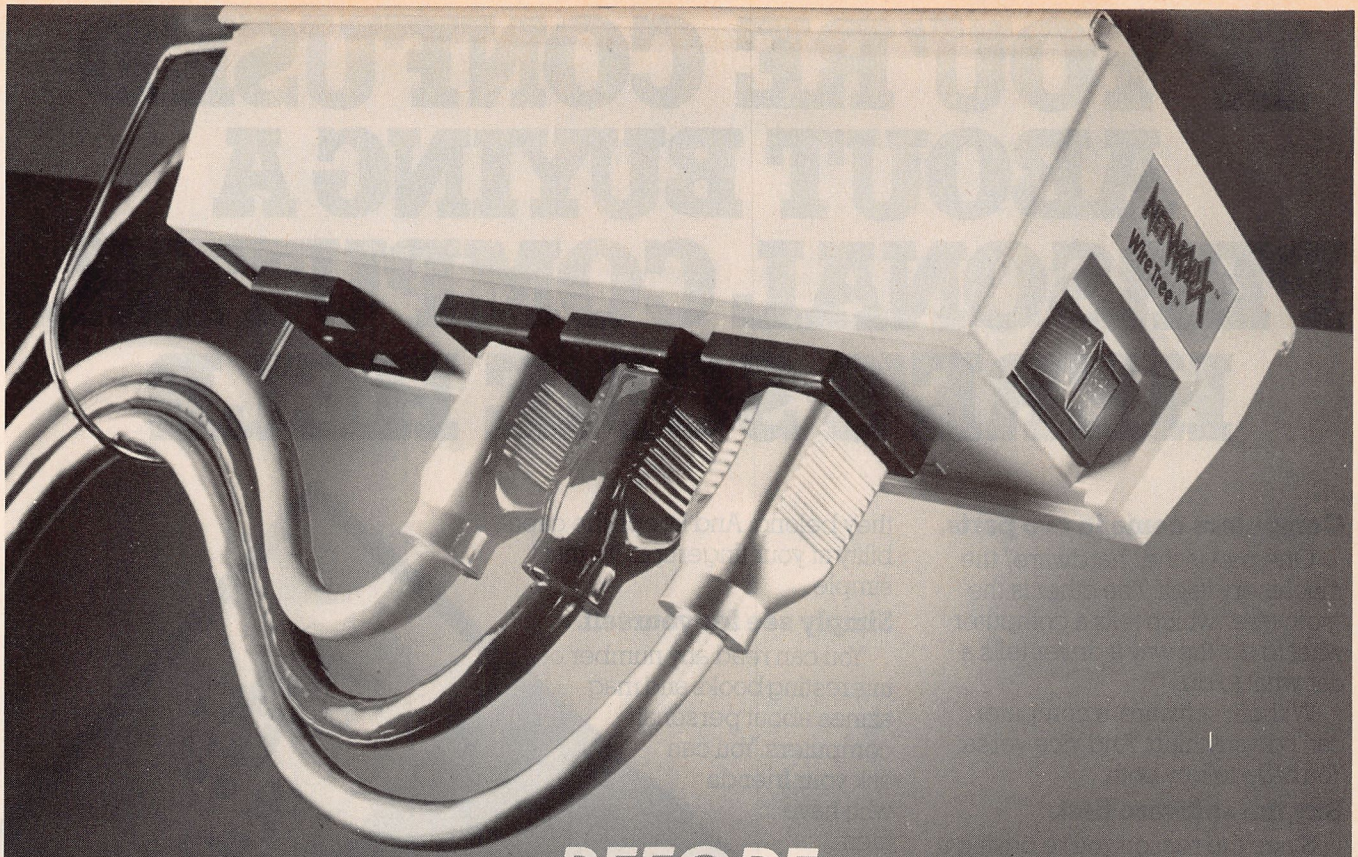

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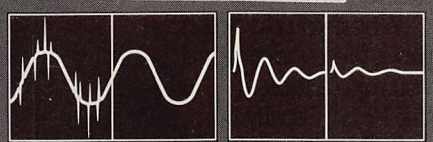

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One part is the "hardware," the machinery itself. The other is the "software," which tells a computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything. And vice versa. You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember it's the software that tells the computer what to do), it makes good sense to pick the software first.

Start by making a list of the things you want the computer to do. Possibilities include word processing, inventory control, accounting, graphics, recordkeeping—you name it, there's probably software that does it.

Next take your list into a computer store and ask the salesperson to demonstrate software that will do the things you want.

Even though you'll need a computer for the demonstration, keep in mind the computer is just a vehicle. The software is the driver. Once you've decided on software, picking the rest of the computer system will be that much easier.

The simpler the better.

Some people will tell you that software has to be complicated to be powerful. Nothing could be further from the truth.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you want to do without getting in the way.

Good software keeps the complications in the computer, where they belong. And keeps the capability at your fingertips. It's that simple.

Simply see for yourself.

You can read any number of interesting books and magazines about personal computers. You can ask your friends who have them.

Or look at all the sales literature you can get your hands on.

But as helpful as that can be, there's no substitute for a live demonstration.

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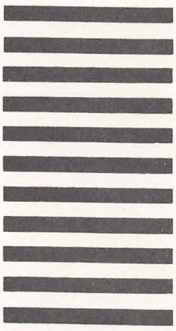

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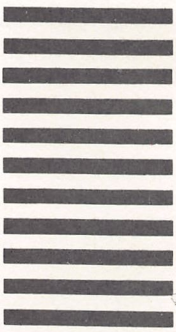

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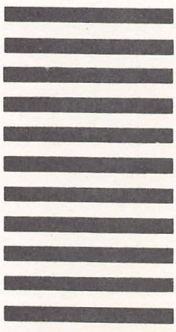

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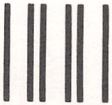

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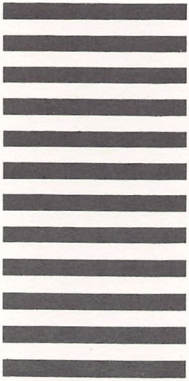
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